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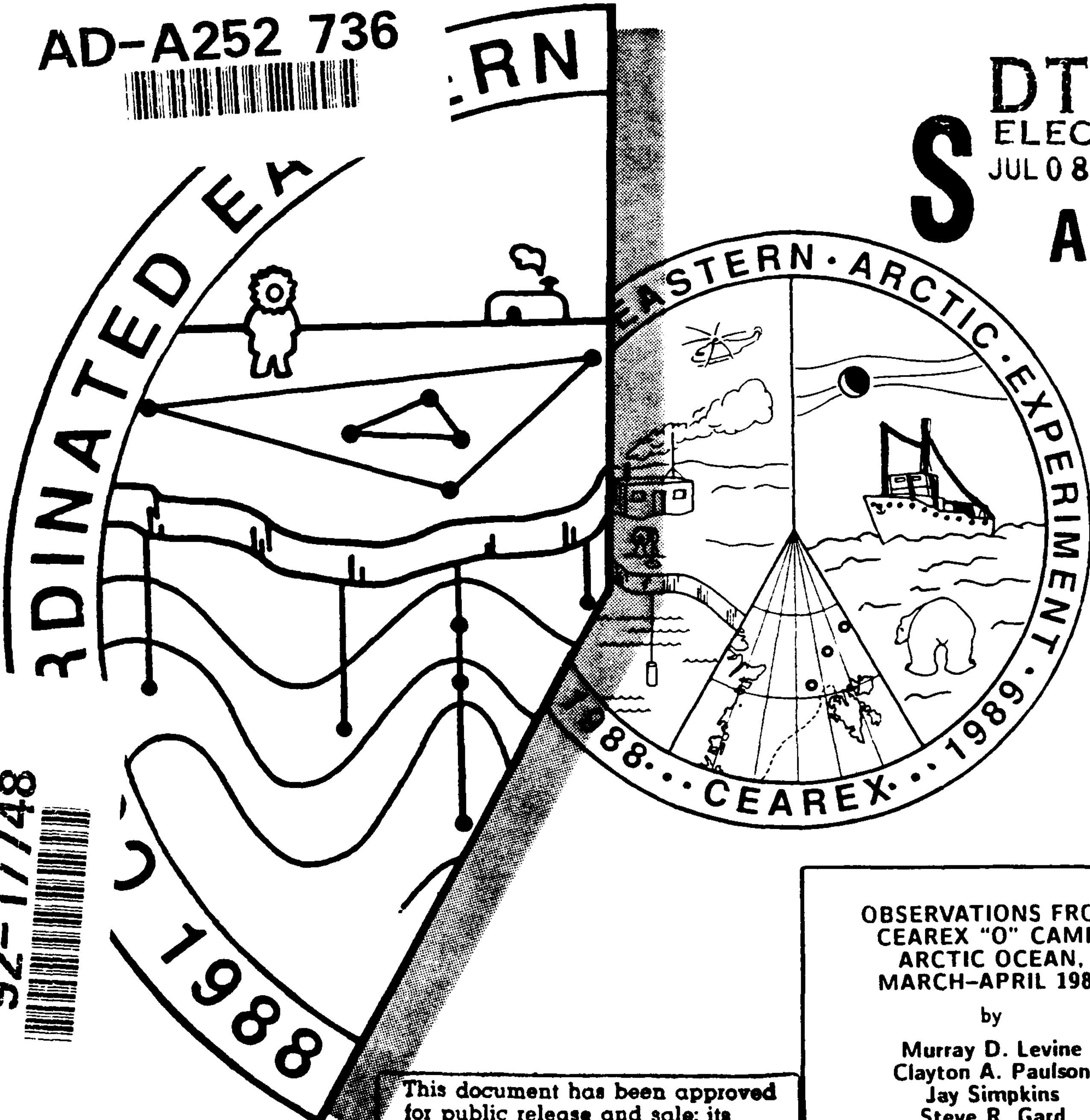

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OREGON STATE UNIVERSITY

OBSERVATIONS FROM CEAREX "O" CAMP, ARCTIC OCEAN, MARCH–APRIL 1989

by

Murray D. Levine
Clayton A. Paulson
Jay Simpkins
Steve R. Gard

Reference 91-1
April 1991
Data Report 152

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This report presents moored observations of velocity, temperature, and conductivity made at the "O" Camp during CEAREX (Coordinated Eastern Arctic Experiment). The measurements were made in the Arctic Ocean, near 83°N and 5° to 11°E, from sensors suspended below the ice during March-April 1989. A variety of instruments were deployed: 7 current meters, 11 temperature sensors, 9 conductivity sensors, 5 temperature-conductivity recorders, and 1 acoustic Doppler profiler. The measurements were made between the surface and 250 m depth; horizontal separations ranged from 75 to 500 m.

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COORDINATED EASTERN ARCTIC EXPERIMENT

1988 · CEAREX · 1989

Observations from

CEAREX "O" Camp

Arctic Ocean

March-April 1989

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Clayton A. Paulson
Jay Simpkins
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We appreciate the labor and enthusiasm of program manager Thomas Curtin in organizing the CEAREX project. The support for this research by the Office of Naval Research through contract N00014-87-K-0009 and grant N00014-90-J-1048 is gratefully acknowledged.

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TABLE OF CONTENTS

INTRODUCTION

This report presents moored observations of velocity, temperature, and conductivity made at the "O" Camp during CEAREX (Coordinated Eastern Arctic Experiment). The measurements were made in the Arctic Ocean, near 83°N and 5° to 11°E, from sensors suspended below the ice during March-April 1989.

The main objectives of CEAREX were to study the processes that control the exchange of momentum, heat and biomass in the eastern Arctic Ocean. The operations at "O" camp represented one part of the CEAREX program. Some of the scientific goals of "O" camp were:

- To determine the energy and spectral composition of the internal wave field,
- To measure the level of turbulent dissipation and mixing,
- To determine the abundance and importance of eddies in the region,
- To determine the importance of trapped diurnal oscillations near the Yermak plateau to internal waves and turbulent processes,
- To determine the importance of double diffusive processes, and
- To study the physics of the atmospheric boundary layer

The specific goals of this project are:

- To compare the internal wave field in the eastern Arctic Ocean with Beaufort Sea (AIWEX) and open ocean observations,
- To investigate the generation of internal waves by the motion of ice keels,
- To investigate the correlation of internal waves with mesoscale processes,
- To assess the importance of tidal forcing on internal wave generation, and
- To cooperate in an investigation of the interaction of internal waves and turbulence.

INSTRUMENTATION

Description

A horizontal and vertical array of instruments measuring current, temperature, and conductivity were suspended from the ice at "O" camp. Instruments included: an acoustic Doppler profiler (RD Instruments), electromagnetic current meters (InterOcean S-4), a Savonius rotor current meter (Aanderaa RCM-8), thermistors (SeaBird SBE-3), platinum electrode conductivity cells (SeaBird SBE-4), and temperature-conductivity recorders (SeaBird Seacat SBE-16).

The sampling strategy was to densely sample in the vertical at a single site. A horizontal array was composed of sensors deployed at 7 other locations, primarily at 100 m depth. A plan view showing the relative location of the Central, Satellite and Comet moorings is presented in Figure 1; the location of observations made by other investigators is also shown.

The vertical distribution of the instruments is shown in Figure 2. A time line showing the duration that each instrument was operating is given in Figure 3. The technical details of each instrument are presented in Tables 1 to 3.

The temperature and conductivity sensors (SeaBird) were connected by individual wires to the central hut to provide power and receive the frequency signal from the sensor. A SBE 11/20 (SeaBird) Deck Unit digitized the frequency signal using a highly accurate hybrid period counting technique. An IBM-compatible laptop computer (Toshiba) acquired the data through an RS-232 line and averaged values over 1 minute intervals. The data were then written simultaneously on 3.5" diskettes and plotted on the screen. The current meters and temperature-conductivity recorders are internally recording instruments.

At the Central site the ADCP was connected to an RDI J-box by a 10 meter cable to provide AC power and receive the output. Data acquisition was controlled by an IBM-compatible 286 using RDI DAS software version 2.34. One-minute averages were recorded on 5.25" diskettes. A complete description of the setup of the ADCP is given in Table 2.

Deployment/Recovery

The first instruments were deployed on 27 March (Day of Year 86). The location of "O" camp as it drifted south and then southwest is shown in Figure 4. The velocity of the drift is shown in detail in Figure 5. These data are from fixes of transit satellites recorded by hand before 4 April and thereafter on magnetic tape. The data

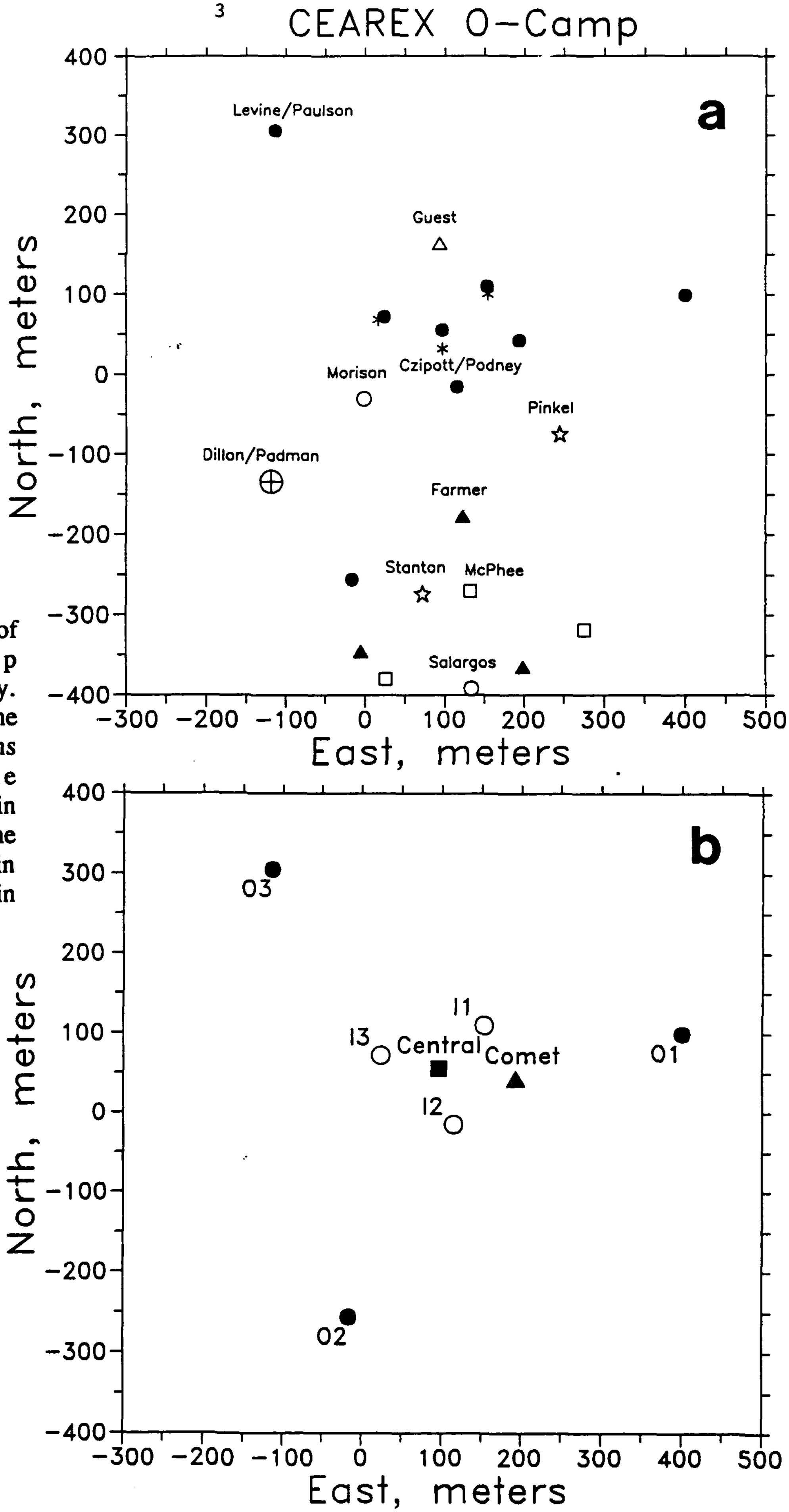


Figure 1. Plan view of CEAREX O-Camp determined by survey. The locations of the scientific observations made by all the investigators are shown in **a.** The locations of the observations discussed in this report are shown in **b.**

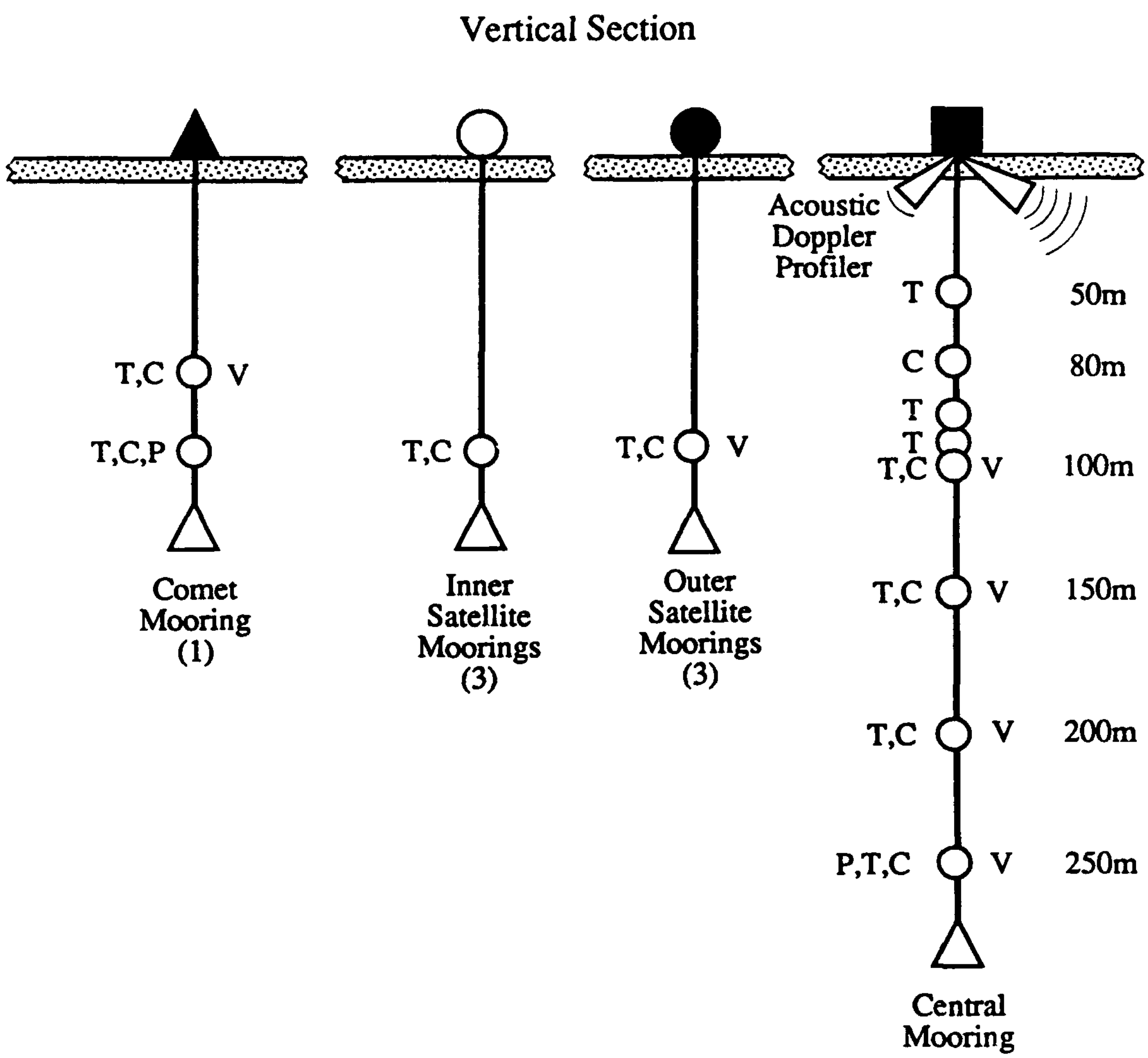


Figure 2. Diagram showing the depths of the temperature (T), conductivity (C), velocity (V), and pressure (P) sensors deployed below the ice at the CEAREX O-Camp.

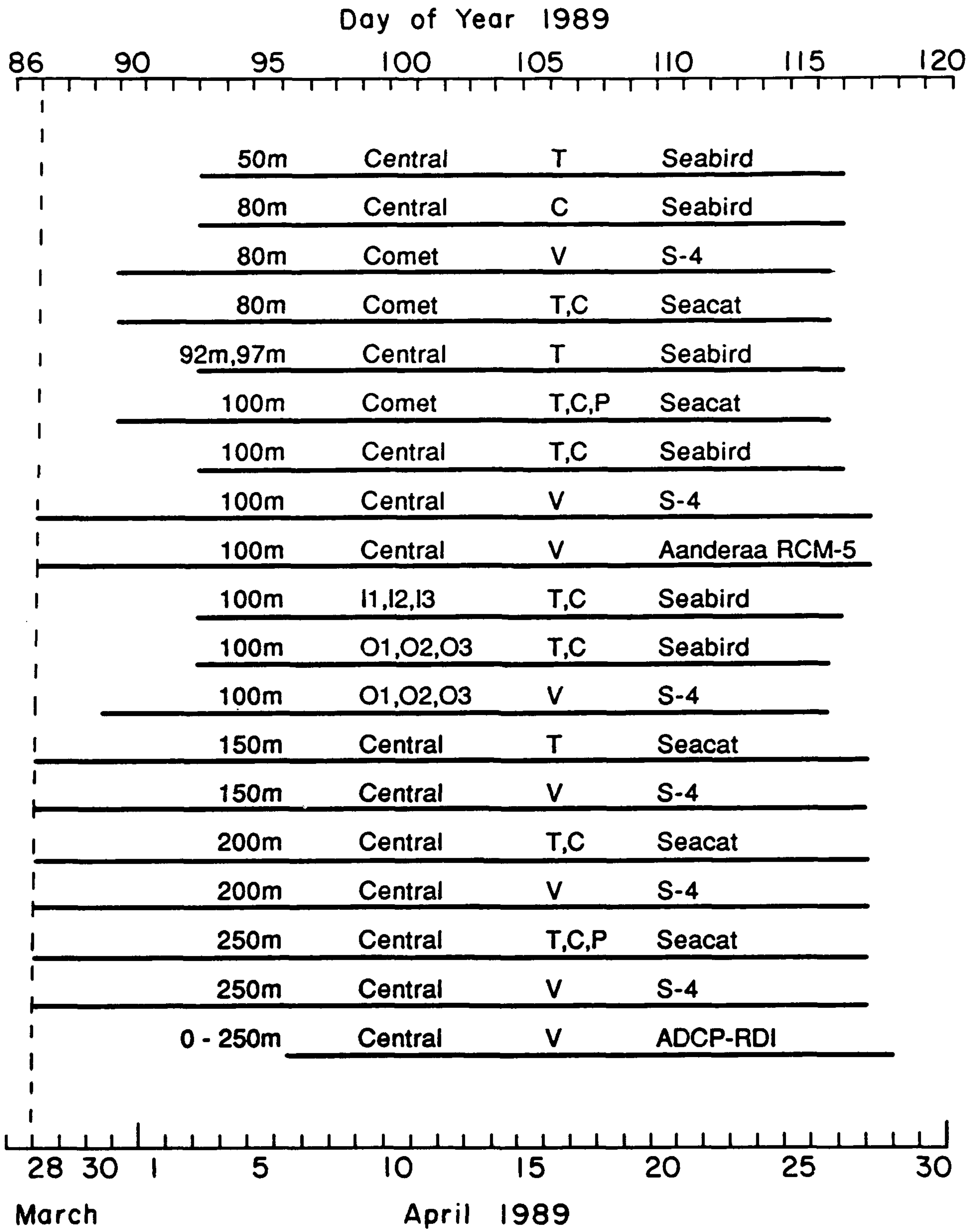


Figure 3. Chart indicating the time that data was recorded from each sensor.

Table 1. CENTRAL MOORING Instrumentation

Depth, m	Type of measurement	Manufacturer*	Serial Number	Model Number	Calibration Source	Additive Constant	Comment
50	T	SBE	543	SBE-3	1/10/90 (-2° to 30°)	0.0	
50	C	SBE	89	SBE-4	Factory 2/2/89	0.0	
80	T	SBE	609	SBE-3	N/A	N/A	Flooded
80	C	SBE	208	SBE-4	11/9/88 relative 519	-.0038 S/m	
92	T	SBE	610	SBE-3	1/10/90 (-2° to 30°)	-.00866°C	
97	T	SBE	611	SBE-3	1/10/90 (-2° to 30°)	-.00395°C	
100	T	SBE	861	SBE-3	1/10/90 (-2° to 30°)	-.00343°C	
100	C	SBE	210	SBE-4	11/9/88 relative 519	-.0002 S/m	
100	V	InterOcean	20642	S-4			
101	V	Aanderaa	4418	RCM-8			Vector averaging
150	T,C	SBE	161415-40	SBE-16	Factory 11/18/88	N/A	
150	V	InterOcean	20655	S-4			
200	T,C	SBE	161415-41	SBE-16	11/9/88 (-.7° to 3°) 11/9/88 relative 519	0.0°C 0.0 S/m	
200	V	InterOcean	20658	S-4			
250	T,C	SBE	161415-50	SBE-16	11/9/88 (-.7° to 3°) 11/9/88 relative 519	0.0°C 0.0 S/m	
250	P	Paro-scientific	21449	8600			Data recorded on SBE 16
250	V	InterOcean	20763	S-4			

* SBE = Sea-Bird Electronics

Table 2. ACOUSTIC DOPPLER PROFILER Technical Information

Parameter	Value	Comment
Acoustic frequency	307 kHz	
Model/serial no.	ADCP-SC #199	Modified for operation at high power with AC. (Option RD-AC-DR)
Bin length	4 meters	
Pulse length	12 meters	
Pings/ensemble	54	Averaging is done in profiler
Percent good threshold	50%	If less than 50% of the pings in the ensemble are good, no data are taken
Speed of sound	1450 m/s	Used internally to calculate velocity
Pitch, roll compensation	Not used	
Compass compensation	Not used in velocity data, but recorded	Data were recorded relative to fixed ADCP. Absolute orientation of beams was done by survey.
Blank beyond transmit	1 meter	Delay from end of transmit to start of data acquisition.

ADCP Depth Bins

Some of the important parameters that controlled the performance of the ADCP include:

c = speed of sound set in acquisition system = 1450 m/s
T = pulse duration in seconds = 12 m x 1.57 ms/m*
D = delay after transmit in seconds = 1 m x 1.57 ms/m*
Δt = bin length in seconds = 4 m x 1.57 ms/m*
H = transducer depth below ice = 2 m
θ = transducer angle = 30°

The depth in meters, z, of the center of each bin can be found using the formula:

$$z=\frac{c}{2}\cos\theta[\frac{T}{2}+D+(B-\frac{1}{2})\Delta t]+H$$

where B = bin number. For these paramters the equation becomes:

$$z=6.9+(B-\frac{1}{2})3.94$$

*Note: RDI uses 1.57 ms/m to convert meters of depth to time.

Table 3. SATELLITE MOORINGS Instrumentation

Mooring	Depth m	Type of measurement	Manufacturer*	Serial Number	Model Number	Calibration Source	Additive Constant	Comment
I1	100	T	SBE	615	SBE-3	1/10/90 (-2° to 30°)	-.02972°C	
I1	100	C	SBE	211	SBE-4	N/A	N/A	Flooded
I2	100	T	SBE	612	SBE-3	1/10/90 (-2° to 30°)	-.02809°C	
I2	100	C	SBE	209	SBE-4	11/9/88 relative 519	-.0016 S/m	
I3	100	T	SBE	862	SBE-3	1/10/90 (-2° to 30°)	-.02383°C	
I3	100	C	SBE	212	SBE-4	11/9/88 relative 519	-.0011 S/m	
O1	100	T	SBE	613	SBE-3	1/10/90 (-2° to 30°)	-.03339°C	
O1	100	C	SBE	363	SBE-4	11/9/88 relative 519	-.0032 S/m	
O1	100	V	Inter-Ocean	20659	S-4			
O2	100	T	SBE	614	SBE-3	1/10/90 (-2° to 30°)	-.03225°C	
O2	100	C	SBE	364	SBE-4	11/9/88 relative 519	-.0016 S/m	
O2	100	V	Inter-Ocean	20660	S-4			
O3	100	T	SBE	616	SBE-3	1/10/90 (-2° to 30°)	-.04151°C	
O3	100	C	SBE	519	SBE-4	Factory 7/22/88	0.0 S/m	
O3	100	V	InterOcean	10764	S-4			
Comet	80	T,C	SBE	161415-43	SBE-16	Factory 11/18/88		
Comet	80	V	InterOcean	20661	S-4			
Comet	100	T,C	SBE	161415-51	SBE-16	Factory 6/11/87	-.008°C	
Comet	100	P	Paro-scientific	21432	8600			Recorded on SBE 16
Comet	100	V	InterOcean	10760	S-4			

* SBE = SeaBird Electronics

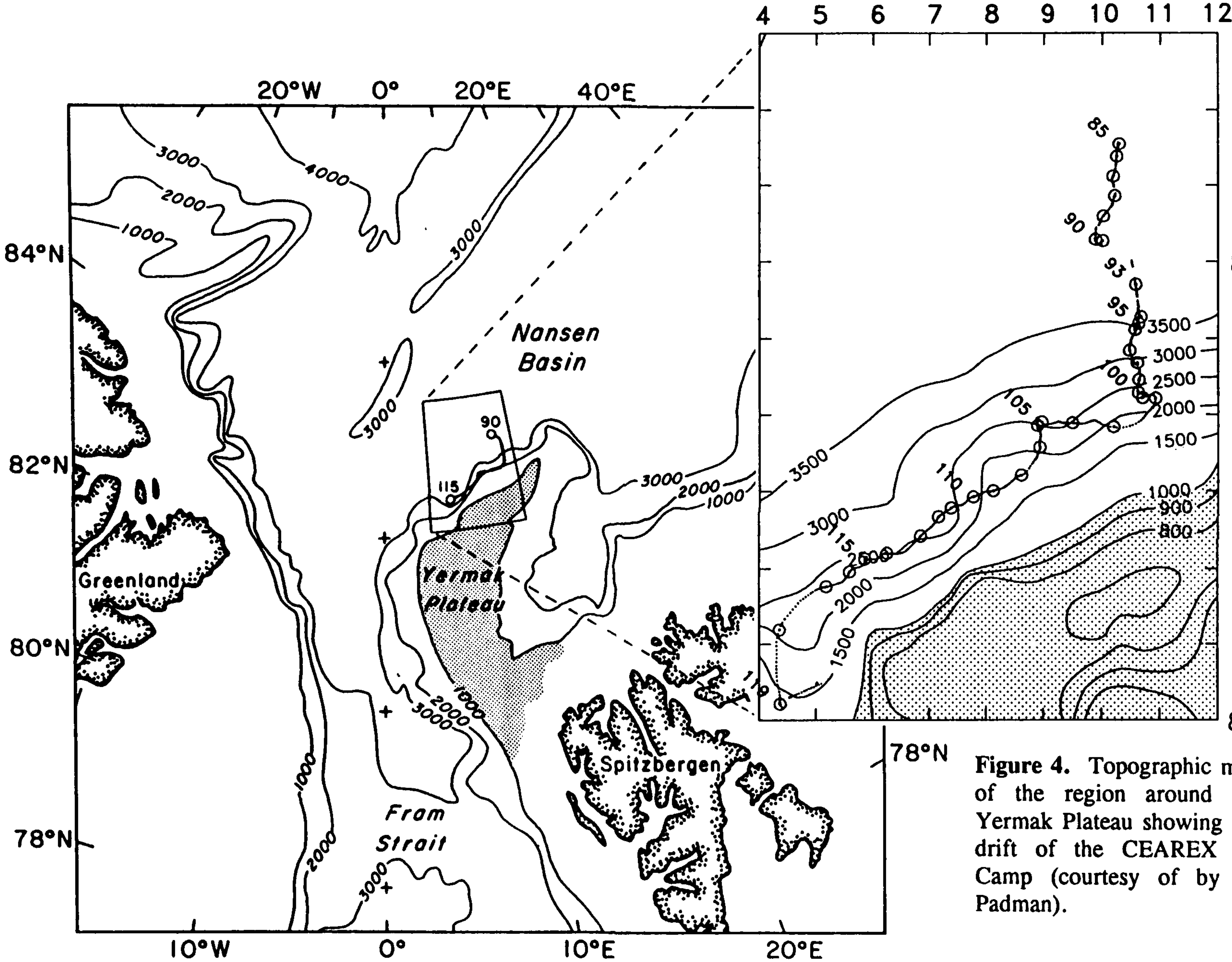


Figure 4. Topographic map of the region around the Yermak Plateau showing the drift of the CEAREX O-Camp (courtesy of by L. Padman).

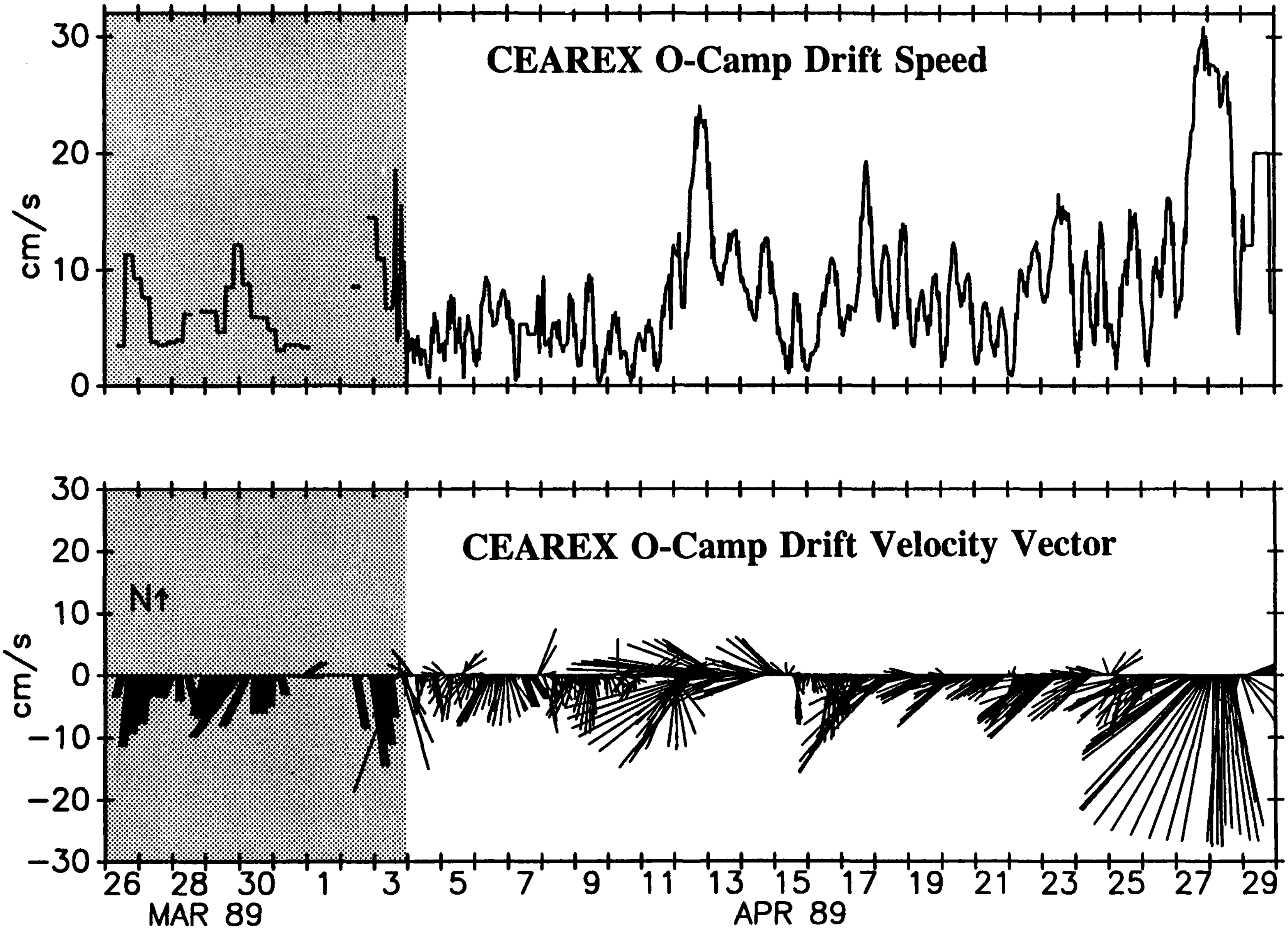


Figure 5. Velocity of the ice camp drift as derived from transit satellite observations. The data were edited, filtered and supplied by Miles McPhee. This ice camp velocity was used to convert water velocity observations made from the ice into absolute velocities (relative to the earth). Water velocity observations made before 4 April were not converted to absolute velocity because of insufficient ice velocity data (shaded).

were edited, filtered and supplied by Miles McPhee (McPhee Research).

The central mooring was deployed from an A-frame mounted inside a hut through a 3-foot diameter hole in the nearly 3-meter thick ice. The strength member of the mooring consisted of 3/8" dacron line. In the upper 100 m a total of 5 temperature and 3 conductivity sensors (SeaBird) were taped to the line. At 100 m two current meters, an InterOcean S-4 and Aanderaa RCM-8, were shackled next to each other. The vane on the RCM-8 was shorter than the standard version to permit deployment through the hole in the ice. At 150, 200 and 250 m current meters (S-4s) and temperature-conductivity recorders (Seacats) were installed in series with the mooring line. The bottom Seacat recorder also contained a pressure sensor (Paroscientific Digiquartz) to monitor mooring motion. The mooring was kept taut with a 300 lb. weight at the bottom. A small electric capstan and cable come-along were used to lower the mooring and transfer loads.

The Satellite moorings were installed by first unspooling the entire length of the preassembled strength member, wire and sensors. The top end of the mooring was attached to a snowmobile. After attaching a 100 lb. weight to the bottom, the mooring was lowered in place by driving the snowmobile toward the hole. An oil drum lying on its side near the hole provided a smooth surface over which the mooring could slide. Wires were then laid across the ice from the top of the mooring to the hut. The Inner Satellite moorings were installed through an 8 inch diameter hole; the Outer Satellite and Comet moorings required a larger 12 inch diameter hole to accommodate the S-4 current meters.

The acoustic Doppler profiler was deployed by hand through another 3-foot hole below the hut at the Central site. The transducers were located 1.7 m below the water level but remained recessed in the hole by about 12 inches. The ADCP was supported by a rigid pipe in a gimbal mounting that allowed the instrument to hang vertically while preventing rotation.

The Satellite moorings were retrieved by drilling a 12 inch hole with the hole melter next to the mooring line. The mooring line was then pulled horizontally into the recovery hole and dragged over an oil drum by a snowmobile. A tripod was positioned over the hole to assist in holding the weight while the current meters were unshackled. The Central mooring and ADCP were retrieved through the same holes through which they were deployed; to keep ice from forming heat was added continuously from the space heater by circulating water through a heat exchanger.

CALIBRATION

Absolute Velocity

Current meters moored from the ice record the sum of the water and ice velocity. To estimate absolute water velocity (relative to the earth), the ice velocity needs to be subtracted from the observations. All the velocity observations presented here *after the start of April 4* are absolute velocities which were estimated using the ice velocity shown in Fig. 5. Before April 4 relative velocities are used, since the ice velocity during this period is not well resolved.

Temperature

A calibration was performed before shipping the sensors to CEAREX in November 1988 at OSU. The bath temperature ranged from -0.7° to 3°C; a platinum thermometer with a Müller Bridge was used as the temperature standard. Unfortunately it was not possible to lower the temperature of the bath to the desired value of -2°C. The sensors that were calibrated included: SeaBird temperature sensor (SBE-3) nos. 543, 609, 610, 611, 612, 613, 614, 615, 616, 861, 862; and SeaBird Seacats (SBE-16) nos. 41, 50, 51.

Another calibration was performed at OSU after CEAREX in January 1990. The bath temperature ranged from -2° to 30°C; again, the platinum thermometer with Müller Bridge was used as the standard. This calibration was found to be consistent with the November 1988 calibration. However, since the range extended to -2°C, the January 1990 results are probably a better choice to use in interpreting CEAREX observations. Unfortunately the Seacats were not included in this calibration. The only drawback for using the January 1990 calibrations is that there is a well-documented long-term drift associated with the Seabird sensors. However, this drift is extremely low in older, aged sensors with serial numbers lower than 616; the two new sensors, nos. 861 and 862, did appear to drift about .02°C in the 21 months between calibrations. Any correction for drift is combined with the adjustment made during the *in situ* calibration described below.

During CEAREX between 0600 and 0700 GMT on Day 106 (16 April) the upper layer was deeper than 100 m and nearly well-mixed. Since many of these sensors were moored at 100 m or less, this permitted an *in situ* intercomparison of sensor calibrations. By comparing the average temperature during this one hour period, it was discovered that there was a positive temperature offset (shift to higher sensor frequency) that seemed to increase as a function of wire length. The largest offset was nearly .04°C for the sensor located at O3. Although the explanation of this offset has not be exhaustively explored, laboratory tests after returning from CEAREX indicate that increased wire length can indeed cause a positive frequency shift.

Final choices of calibration constants were based on examining the results of all three

calibrations: November 1988, January 1990, and CEAREX *in situ* comparison. Sensor no. 543 was believed to be relatively free of the effects of wire length, since it was only 50 m, and hence the calibrations from January 1990 were used without correction. Therefore the temperature at 50 m from no. 543 was used as the standard for the *in situ* calibration. To transfer this standard to depths of 92, 97 and 100 m, vertical temperature differences measured with the RSVP by T. Dillon and L. Padman (OSU) were used. Specifically casts at 0620 and 0640 were used to adjust the standard at 50 m to other depths. To force all sensors to agree during this *in situ* comparison (presumably accounting for wire length effects) a constant was added to the January 1990 calibrations (see Table 4a). Sensor no. 609 flooded on deployment and produced no data. Seacats have no wire and hence are not subject to this offset. Therefore, November 1988 calibrations were used for Seacat nos. 41 and 50. Nos. 43 and 40 were repaired and calibrated at the factory just prior to CEAREX. No. 51 showed large deviations near -2°C when the November 1988 and original factory calibrations were compared; hence it was decided to use the factory calibrations (June 1987) and add -.008°C to adjust for long-term drift.

Conductivity

A calibration was performed at OSU in November 1988 during the temperature calibration described above. The sensors that were calibrated included: Seabird conductivity sensors (SBE-4) Nos. 208, 209, 210, 211, 212, 363, 364, 519; and Seacats (SBE-16) nos. 41, 50, 51. Seawater from Newport was used in the bath, and a Guildline salinometer calibrated with Copenhagen standard water was used to determine salinity. A new Seabird conductivity sensor (SBE-4) no. 519 was included in the calibration bath. Comparisons between this sensor and our determination of the bath conductivity indicated a .004 Siemens/m offset (at -1°C the factory calibrations give a *higher* conductivity than our bath indicated). A recent factory calibration in April 1990 of the same sensor indicated a drift of only about .001 S/m over the entire 21 month life of the sensor. Comparison with the conductivity observed by J. Morison (APL/UW) during the CEAREX *in situ* calibration indicated that a .004 S/m offset was unreasonable. Therefore, we have used no. 519 as the standard for the November 1988 calibration. Note that we used a polynomial fit to the data rather than the analytical form used by Seabird, which was found to be unstable over the short range of this calibration. No conductivity calibration was attempted during the temperature calibration of January 1990.

During the CEAREX *in situ* calibration described above it appeared that there was an offset of conductivity due to wire length just as was observed for temperature sensors. However, the trend was not obviously a monotonic function of wire length. The greatest outlier in this trend was no. 519 which was at the end of the longest wire, yet produced reasonable results. Perhaps this newest version sensor has a different line driver? Another possible complication is that some of the sensors during the November calibrations at OSU were connected with a long wire--unfortunately we do not know which sensors. Obviously, this further complicates the calibration determination.

Table 4. Temperature & Conductivity Calibrations

TEMPERATURE CALIBRATION used for CEAREX

S/N	Mooring	Depth	Calibrations	Additive Constant
543	Central	50	1/10/90 (-2° to 30°)	0.0
610	Central	92	1/10/90 (-2° to 30°)	-.00866
611	Central	97	1/10/90 (-2° to 30°)	-.00395
861	Central	100	1/10/90 (-2° to 30°)	-.00343
615	I1	100	1/10/90 (-2° to 30°)	-.02972
612	I2	100	1/10/90 (-2° to 30°)	-.02809
862	I3	100	1/10/90 (-2° to 30°)	-.02383
613	O1	100	1/10/90 (-2° to 30°)	-.03339
614	O2	100	1/10/90 (-2° to 30°)	-.03225
616	O3	100	1/10/90 (-2° to 30°)	-.04151
43	Comet	80	FACTORY 11/18/88	0.0
51	Comet	100	FACTORY 6/11/87	-.008
40	Central	150	FACTORY 11/18/88	0.0
41	Central	200	11/9/88 (-.7° to 3°)	0.0
50	Central	250	11/9/88 (-.7° to 3°)	0.0

CONDUCTIVITY CALIBRATION used for CEAREX

S/N	Mooring	Depth	Calibrations	Additive Constant (mS/cm)
89	Central	50	FACTORY 2/2/89	0.0
208	Central	80	11/9/88 relative 519	-.038
210	Central	100	11/9/88 relative 519	-.002
209	I2	100	11/9/88 relative 519	-.016
212	I3	100	11/9/88 relative 519	-.011
363	O1	100	11/9/88 relative 519	-.032
364	O2	100	11/9/88 relative 519	-.016
519	O3	100	FACTORY 7/22/88	0.0
43	Comet	80	FACTORY 11/18/88	0.011
51	Comet	100	FACTORY 6/11/87	0.0
40	Central	150	FACTORY 11/18/88	0.0
41	Central	200	11/9/88 relative 519	0.0
50	Central	250	11/9/88 relative 519	0.0

The final choice of calibration constants was determined as follows (see Table 4b). As with temperature, the sensor at 50 m (no. 89) was considered to be relatively free from the effects of wire length. Since it was a newly refurbished and calibrated sensor (February 1989), the factory calibrations were used. Sensor no. 519 (July 1988 calibration) and Seacat no. 51 (June 1987 calibration) gave consistent values of conductivity during the *in situ* calibration and therefore were used as the standard for 100 m. Hence for sensor nos. 210, 209, 212, 363, 364, the November 1988 calibrations (relative to no. 519) were used with an additive offset forcing agreement with sensors no. 519 and no. 51. The standard used at 80 m during the *in situ* calibration was obtained by using the 50 m value from sensor no. 89 and adding the conductivity *difference* measured by the RSVP during this time. To match this standard, a constant was added to the November calibrations of nos. 208 and 43. The calibrations for the Seacats nos. 40, 41 and 50 were from the same calibrations as used for temperature.

Magnetic Declination

The magnetic declination is needed to correct compasses in the S-4 and Aanderaa current meters in order to determine the absolute direction of water velocity. The declination at the O camp changed with time because the camp moved. It was measured directly by Roger Andersen (APL/UW) using a small hand-held compass at the time a sun shot was made (Fig. 6). The resulting time series is noisy and contains gaps when the sun was not visible. An independent estimate of declination was kindly provided by Shaul Levi (Oregon State University) by evaluating a global fit of declination at O camp positions. This series is relatively smooth and follows Andersen's values on average (Fig. 6). Values ranged from -6° to -11° over the course of the experiment. For simplicity it was decided to use a constant value of -7° to correct the current meter records. The equation relating a heading measured with a compass, H, and the heading relative to true north, T, is given by:

$$H - 7° = T,$$

that is, true north points in a direction 7° clockwise from the direction of magnetic north.

Compass Check

The compass in each S4 current meter was checked before shipping at OSU. Each instrument was mounted on a stand and rotated in 10° increments (Fig. 7a). The average deviation from the expected values was about 1° for all instruments. The variation about this average ranged from ±1° to ±5°.

A compass check of all current meters was performed at O camp after recovery. Each instrument was mounted on a stand with data taken every 45° of rotation (Fig. 7b). As the instrument was rotated around the compass, the average deviation from the expected values ranged from near 0° to 6°. The variation about this average ranged from ±5° for some instruments to as large as ±10° for others. This variation is

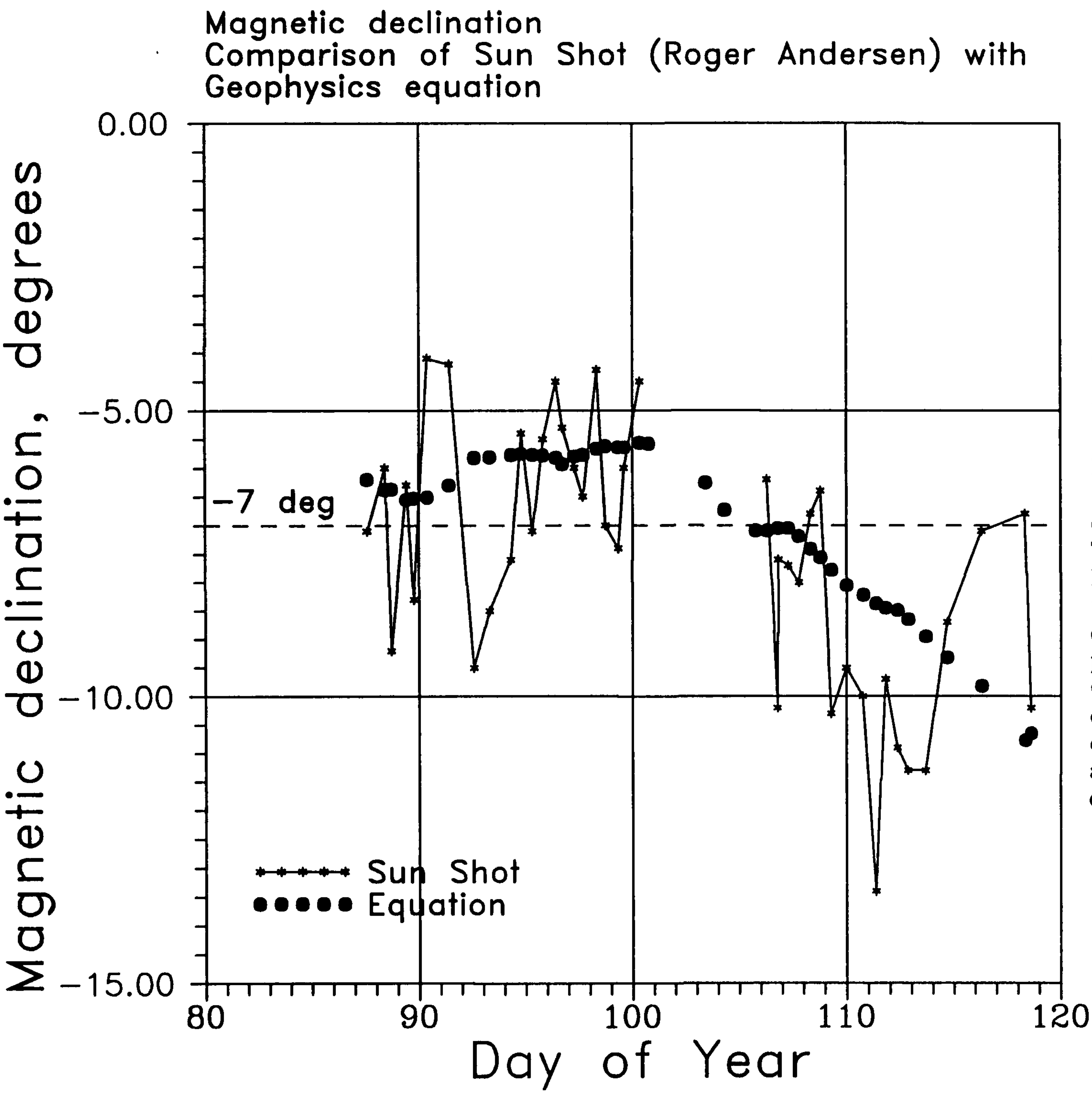


Figure 6. The magnetic declination at the location of the ice camp estimated by two methods. Direct estimates (labeled Sun Shot) were made (Roger Andersen, UW/APL) by determining magnetic north from a hand-held compass and true north from measuring the position of the sun with a theodolite. The other estimate (labeled Equation) was determined from a best-fit function of the earth's magnetic field (kindly provided by Shaul Levi, Oregon State University). A constant magnetic declination of -7° was chosen to correct all the compasses in the current meters.

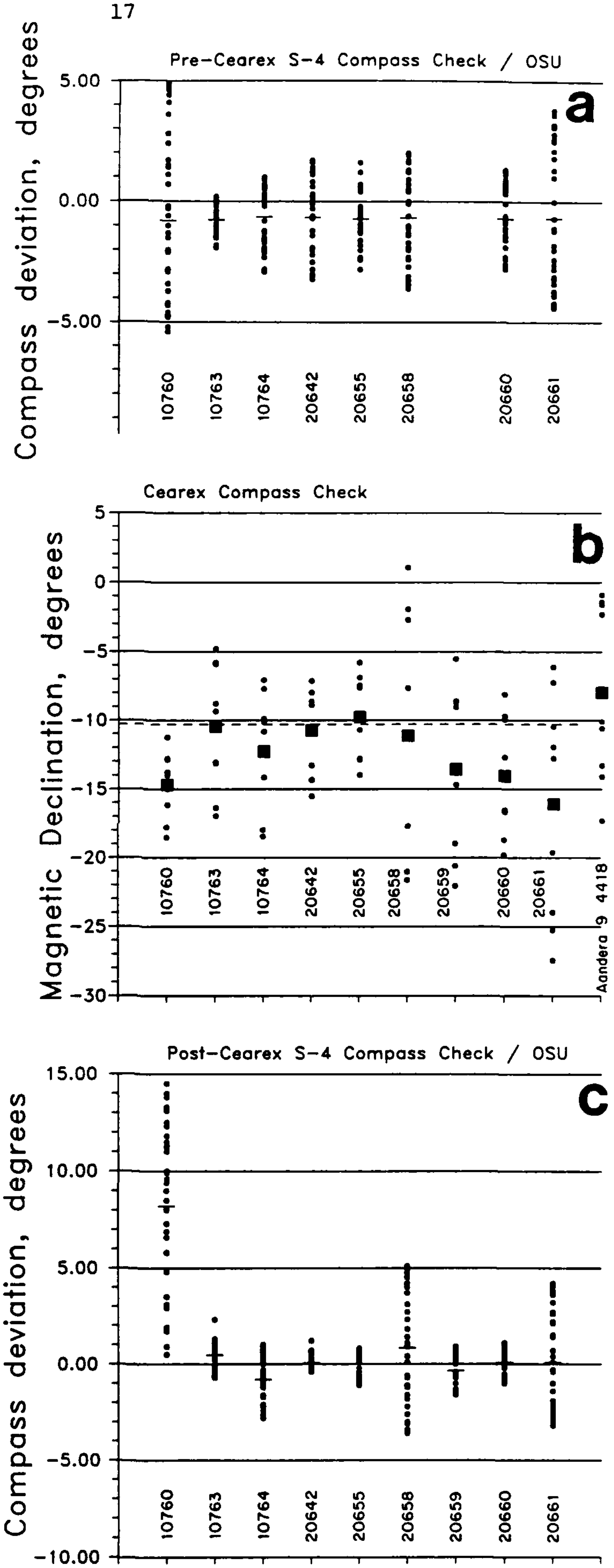


Figure 7. The deviation of the current meter compasses (identified by serial numbers, see Tables 1 & 3) from the expected direction as they are rotated is shown before the experiment (a) and after (c). A compass check was also made at CEAREX (b) by comparing the magnetic declination determined by the compass, as it was rotated at different angles, with the actual value (dashed line). The average value of all the different angles is also indicated (square).

much greater than was found at OSU for the same instruments. It is not clear if the large variations are due to the cold weather or the weakness of the horizontal component of the magnetic field. In any case no correction to the measured data was made based on this compass check.

A post-Cearex compass check of the S4s was also performed at OSU (Fig. 7c). The average deviation from expected values was within 1°, except for #10760, which showed an average deviation of 8°. The variation about this average ranged from ±1° to ±4°, except for #10760, which showed variations of ± 7°. It appears that the problem with the compass on #10760 was intermittent. This can be seen by comparing the Cearex data from this instrument with another instrument at the same depth but different location. Therefore, data from this instrument located at Comet 100 m is not shown in this report.

ADCP Alignment Procedure and Camp Azimuth

Since the ADCP was rigidly mounted to the ice, the horizontal orientation of the camp is needed in order to relate the velocities to true north. The Camp Azimuth was defined as the clockwise angle between the lines: Central site-to-true north and Central site-to-theodolite (Fig. 1). Camp Azimuth was estimated by Roger Andersen on a daily basis, weather permitting, using the sun to determine true north (Fig. 8).

A compass mounted rigidly to the ice on the ADCP was also used to estimate variations in Camp Azimuth. To relate the compass values to true north, the time-varying magnetic declination supplied by Levi was used (Fig. 6). The low frequency variations agree well with Andersen's Camp Azimuth, except that an *ad hoc* constant offset of 18° needed to be applied to the ADCP compass. The time variability of the compass appears to be reasonable; the cause of this offset is not yet known. It therefore appears that while the compass data cannot be used to determine absolute Camp Azimuth, it can provide high-frequency observations of camp rotation. This may be useful in interpolating missing values from Andersen's Camp Azimuth record.

The line from beam 4 through beam 3 is used to reference the ADCP to true north (Fig. 9). The orientation of this line was determined by the camp survey. The ADCP software assumes that beam 3 points northward. To calculate velocities relative to true north, the reference frame was rotated 155° anticlockwise. This rotation is based on a 240° Camp Azimuth. As the camp rotates an additional rotation of the coordinate is needed; however, the time-dependent Camp Azimuth correction was not applied to the data. For most of the experiment the Camp Azimuth was between 235° and 240° (Fig. 8).

Therefore, the orientation of the individual beams for a 240° Camp Azimuth was: Beam 1, 245°; Beam 2, 65°; Beam 3, 155°; Beam 4, 335° (angles measured clockwise from true north).

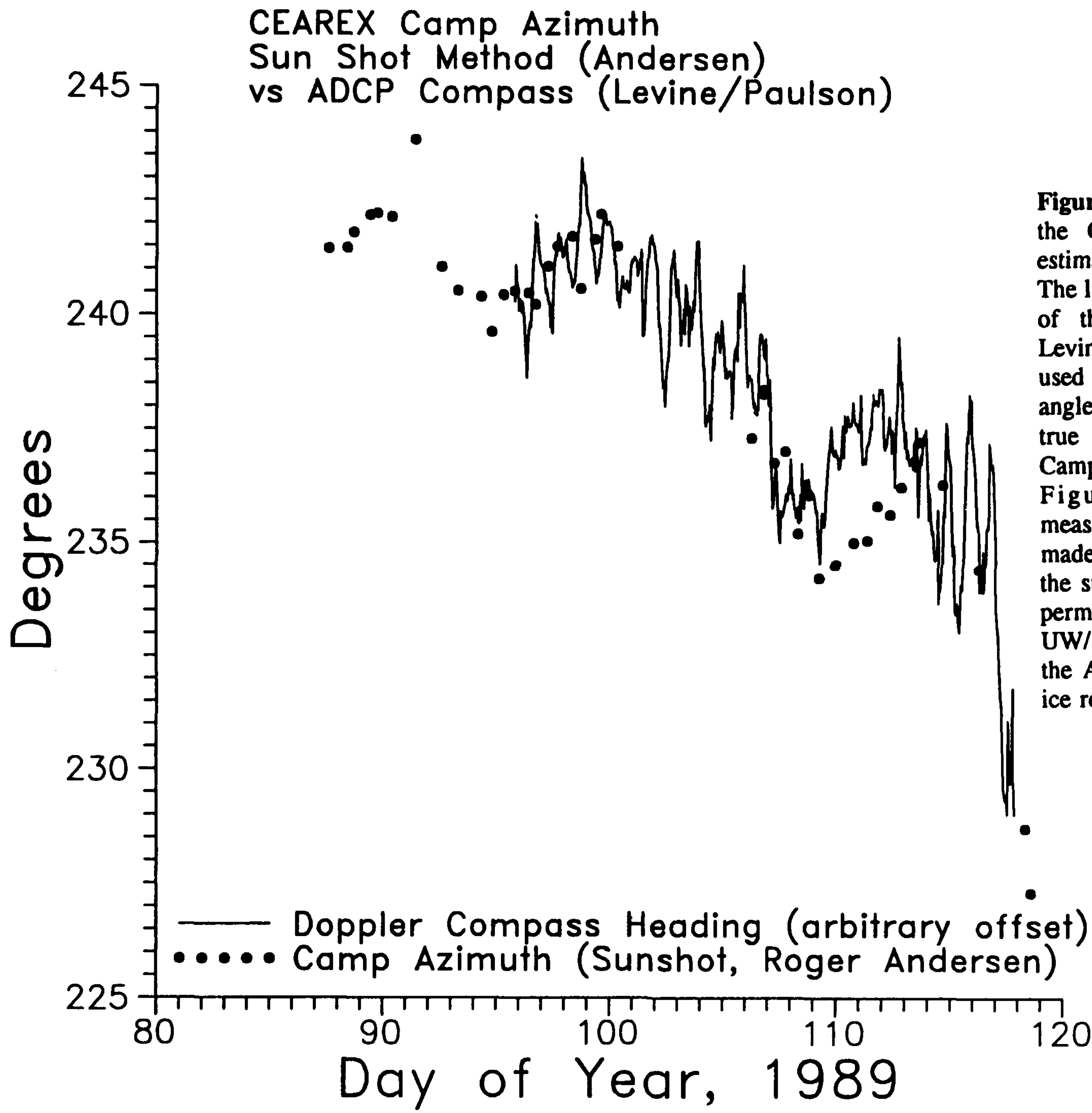


Figure 8. The rotation of the O-Camp ice floe was estimated by two methods. The line between the location of the theodolite and the Levine/Paulson stovepipe was used as the reference. The angle between this line and true north was called the Camp Azimuth (also see Figure 9). Direct measurements (dots) were made with a theodolite using the sun as reference weather permitting (Roger Andersen, UW/APL). The compass on the ADCP also recorded the ice rotation (solid line).

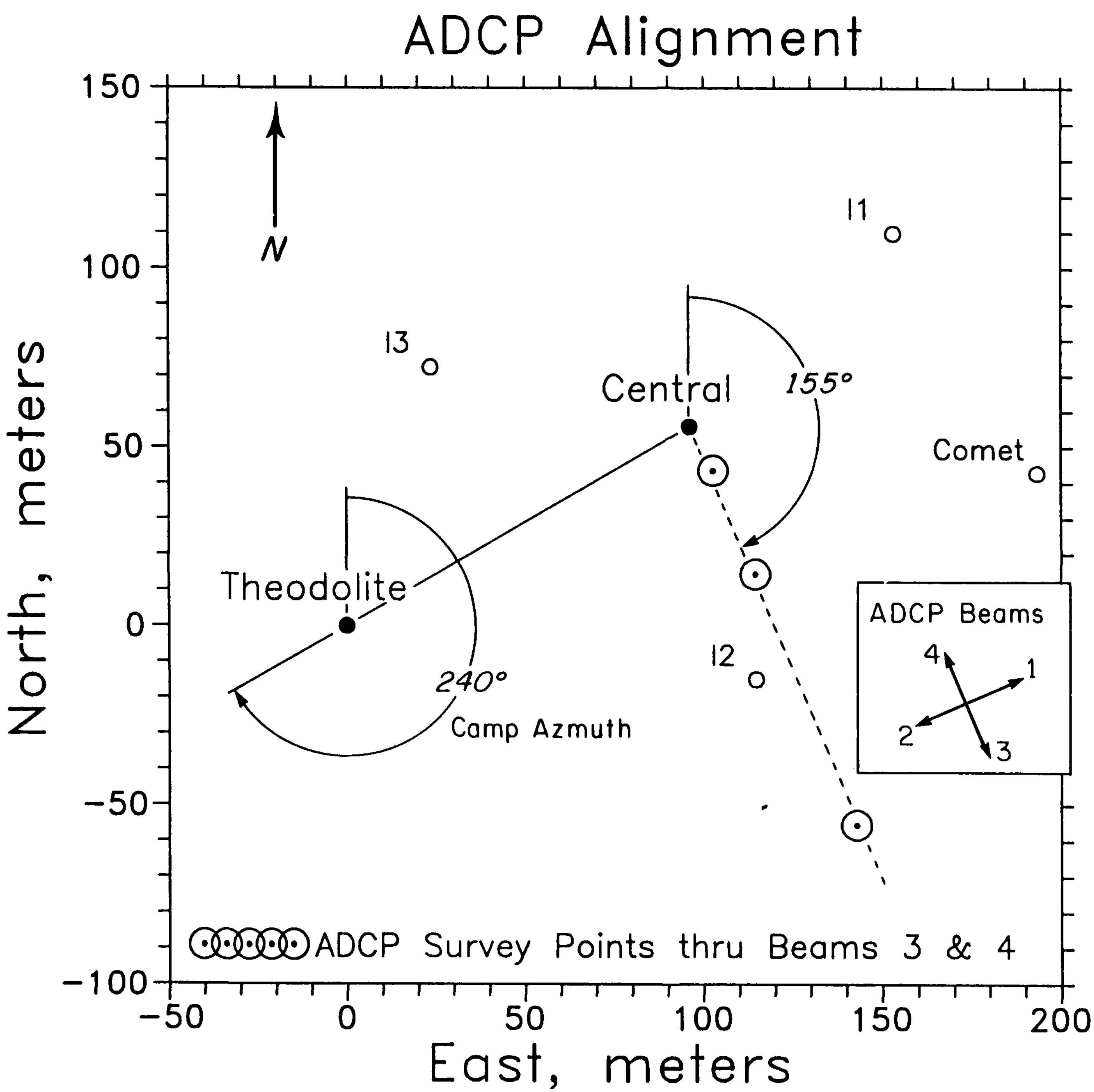


Figure 9. Detailed diagram of the orientation of the four beams of the ADCP. The figure is drawn assuming a 240° Camp Azimuth. The time dependence of the Camp Azimuth is shown in Figure 8.

Pressure/Depth

Pressure sensors (Paroscientific) were located at the end of the Comet and Central moorings (see Tables 1 & 3). Factory calibrations were used to convert the data to absolute pressure. A constant value of 10 db was subtracted for the atmospheric contribution to the total pressure (Fig. 10).

A significant portion of the observed pressure fluctuations can be attributed to the atmospheric variations (Fig. 10). This is demonstrated by comparing the atmospheric pressure record (Guest and Davidson; Naval Postgraduate School, Monterey) with the observed pressure. Other fluctuations are due to the tilting of the mooring caused by horizontal velocity of the water relative to the ice.

The factors used to convert pressure in decibars to depth in meters are .98776 and .98412, for 100 m and 250 m respectively. These values are based on a value of gravitational acceleration of 9.831 m/s^{-2} and the average value of *in situ* density from RSVP profiles--1027.5 kg/m^{-3} and 1027.65 kg/m^{-3} from 100 and 250 m respectively (Padman and Dillon, 1990). The best estimate of the depths of the sensors are 99.7 m and 249.7 m; extremely close to the target depths of 98.8 and 248.8 m.

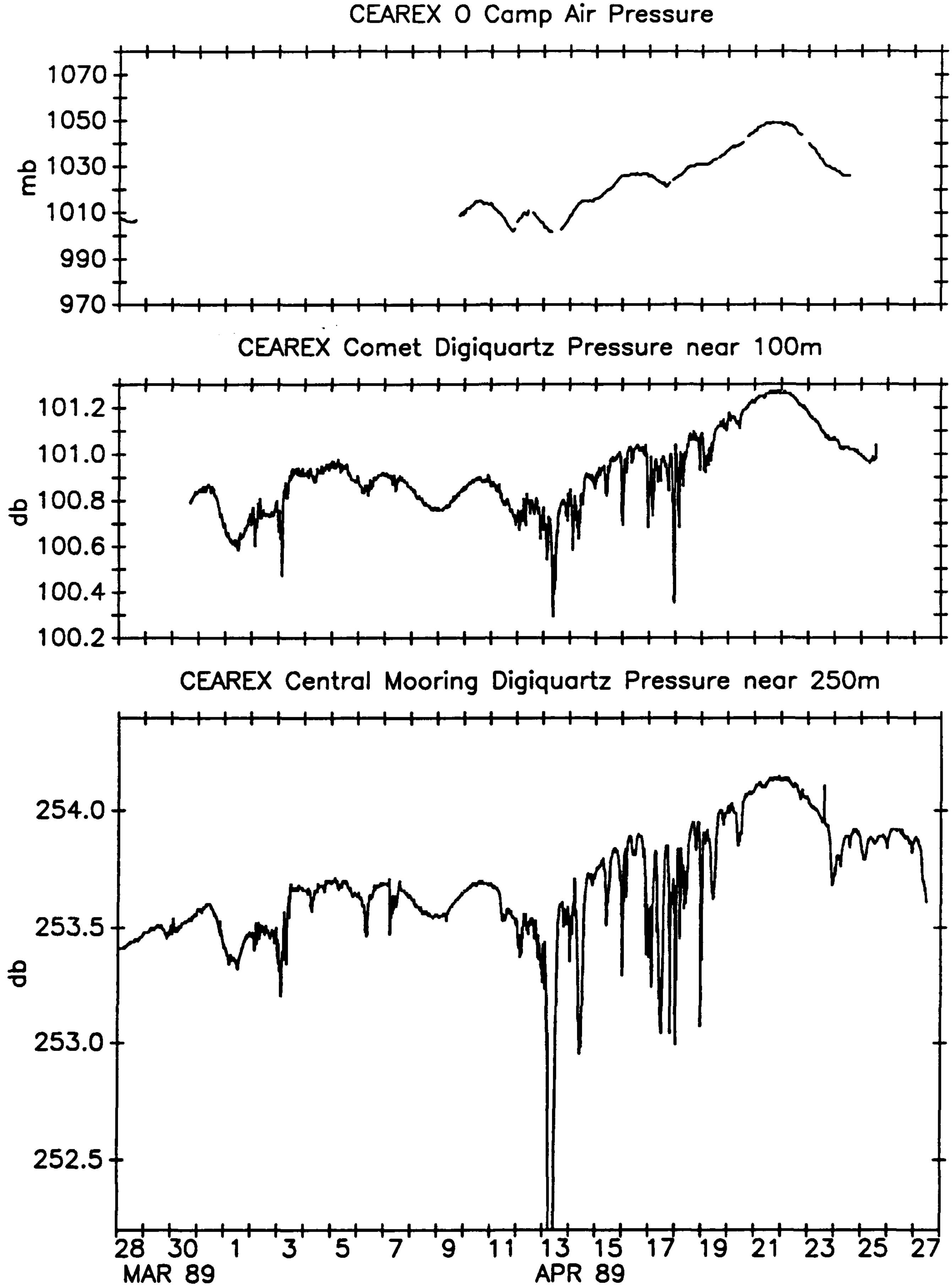
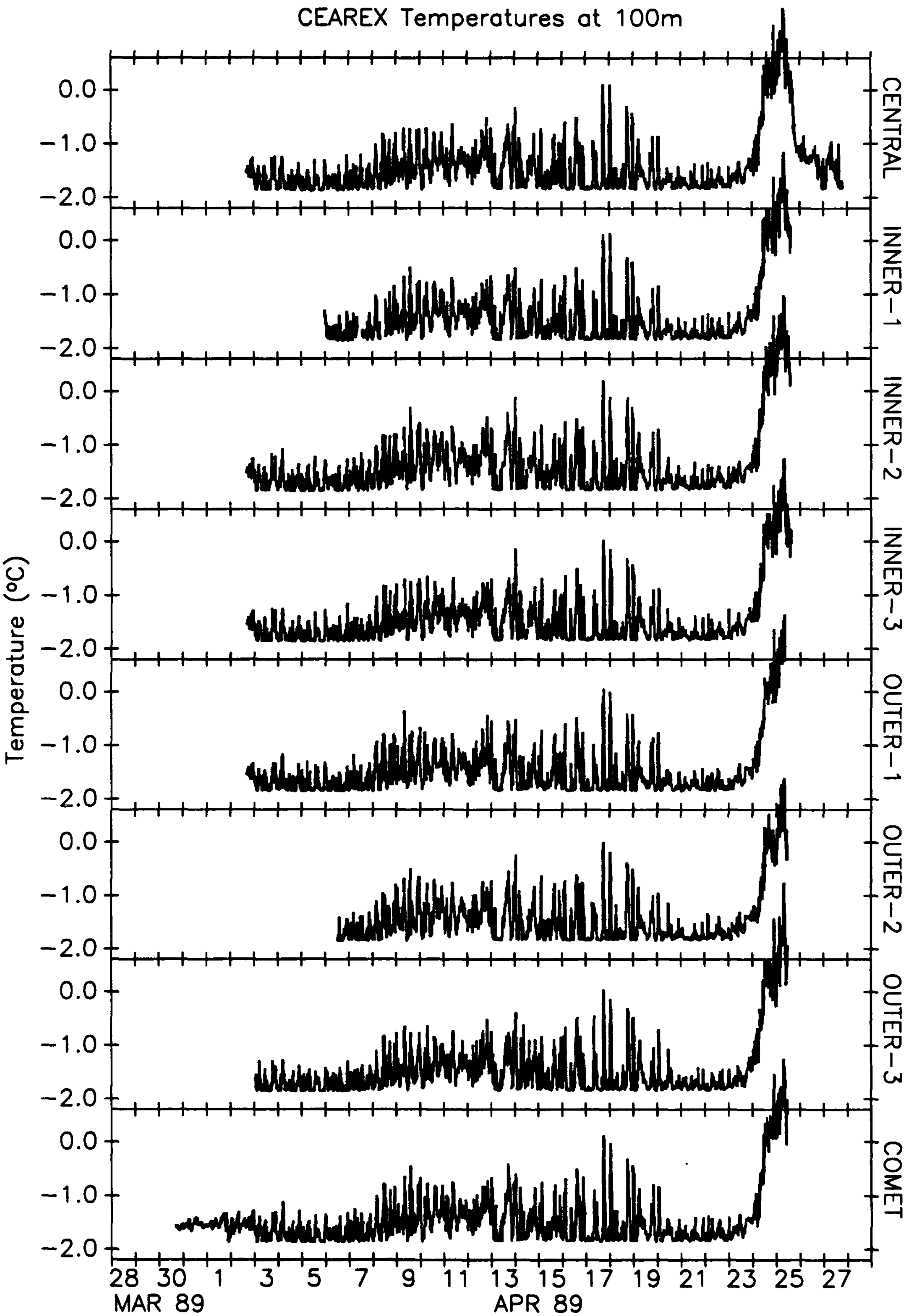


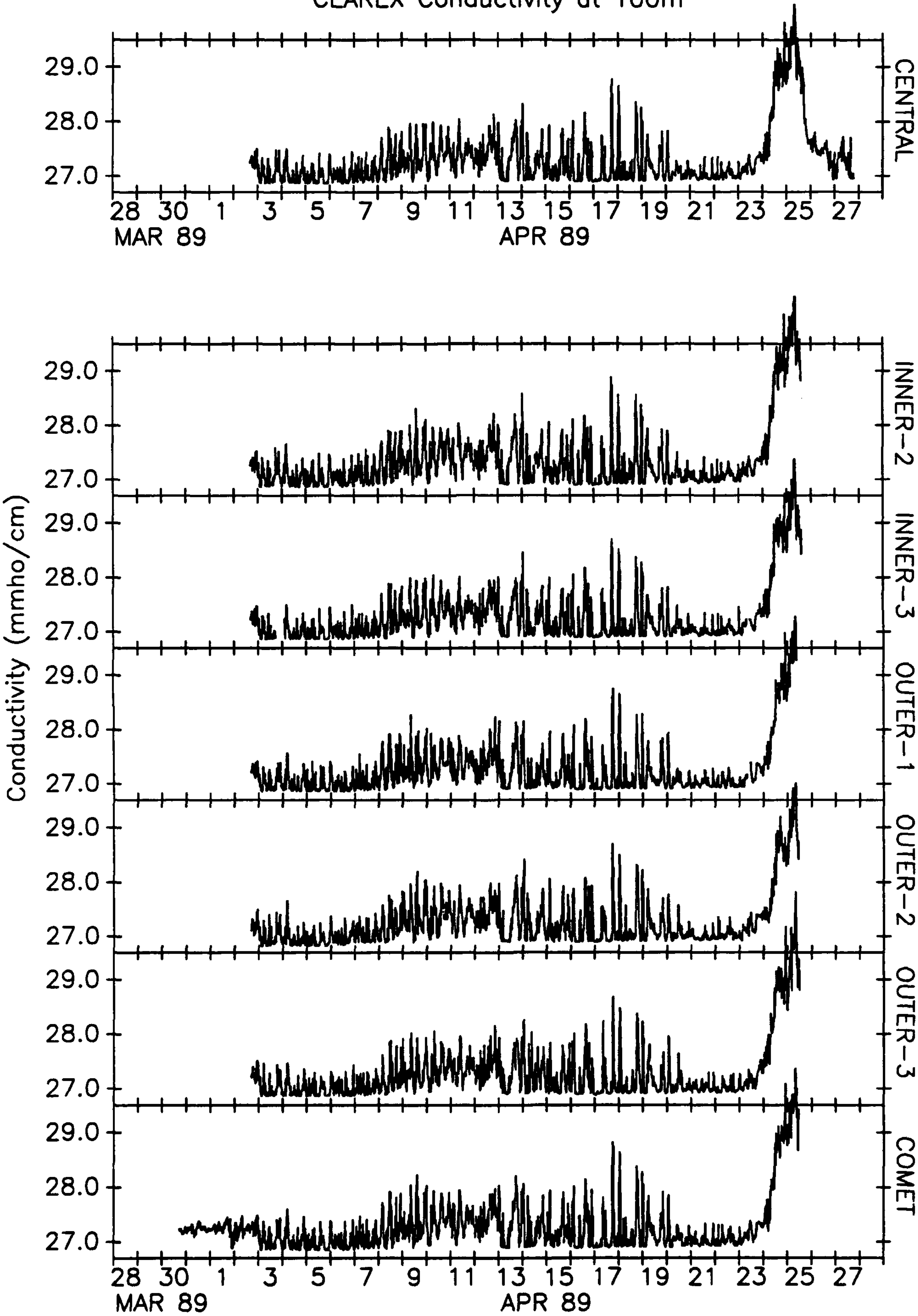
Figure 10. The pressure recorded at the bottom of the Comet and Central moorings. For comparison the atmospheric pressure is also shown.

TIME SERIES AT 100 m: LOW-PASS FILTERED

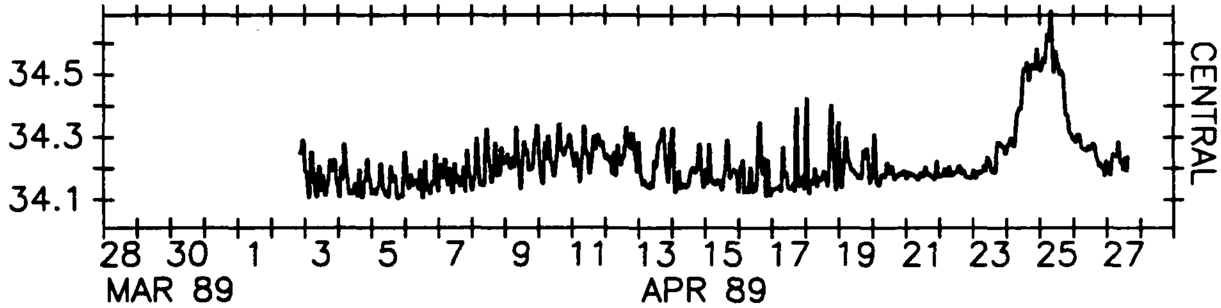
The following four plots are observations of temperature, conductivity, salinity and velocity at 100 m depth from the Central, I1, I2, I3, O1, O2, O3 and Comet moorings. Temperature and conductivity observations are from individual SeaBird sensors except for the Seacat temperature-conductivity recorders used on the Comet mooring. The velocity observations are from S-4 current meters. Note: absolute velocities are presented after the start of April 4; relative velocities are shown before. (See Tables 1 and 3.)

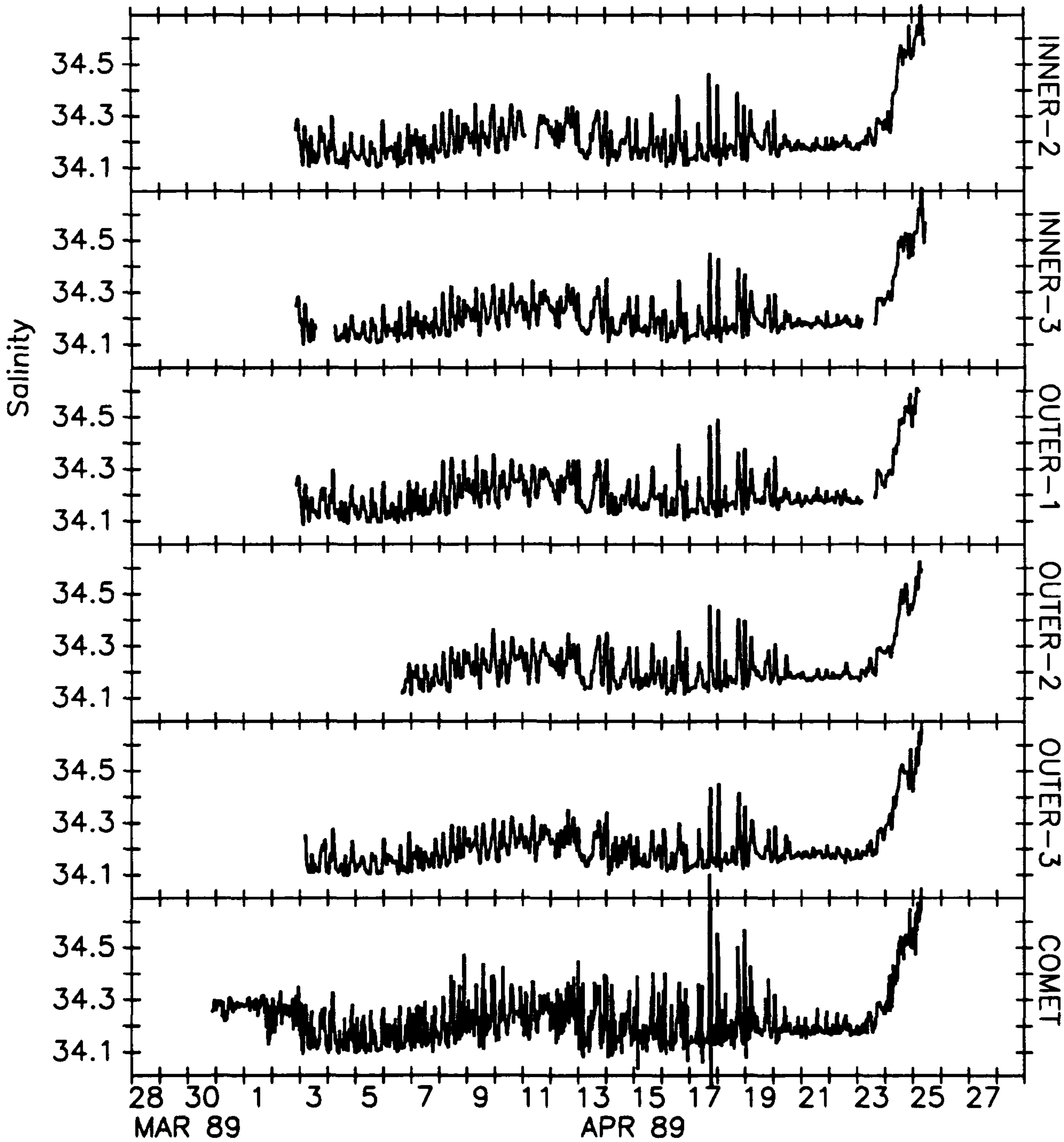

CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
28 30 1 3 5 7 9 11 13 15 17 19 21 23 25 27
MAR 89
APR 89

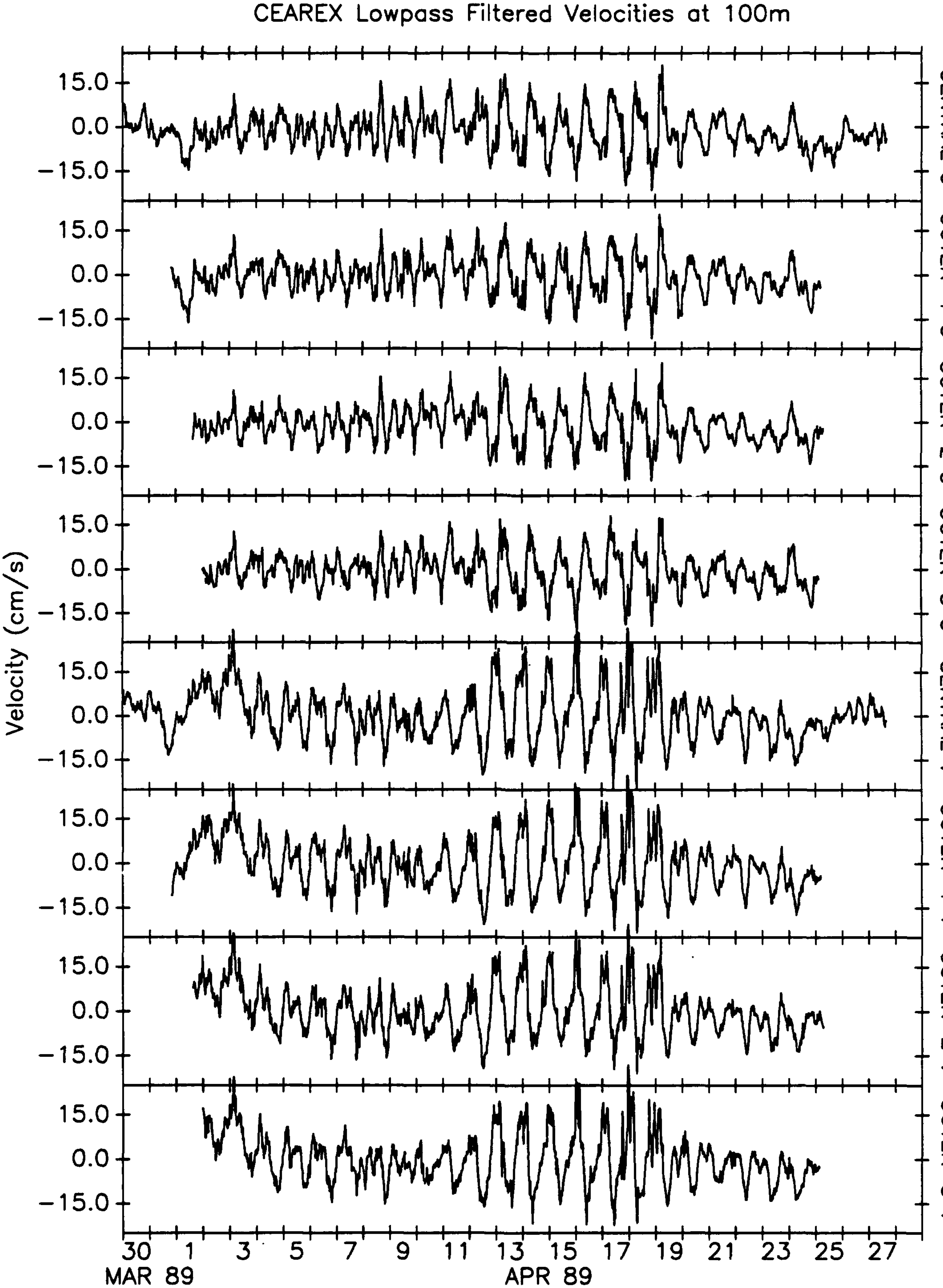
CEAREX Conductivity at 100m



CEAREX Salinity at 100m





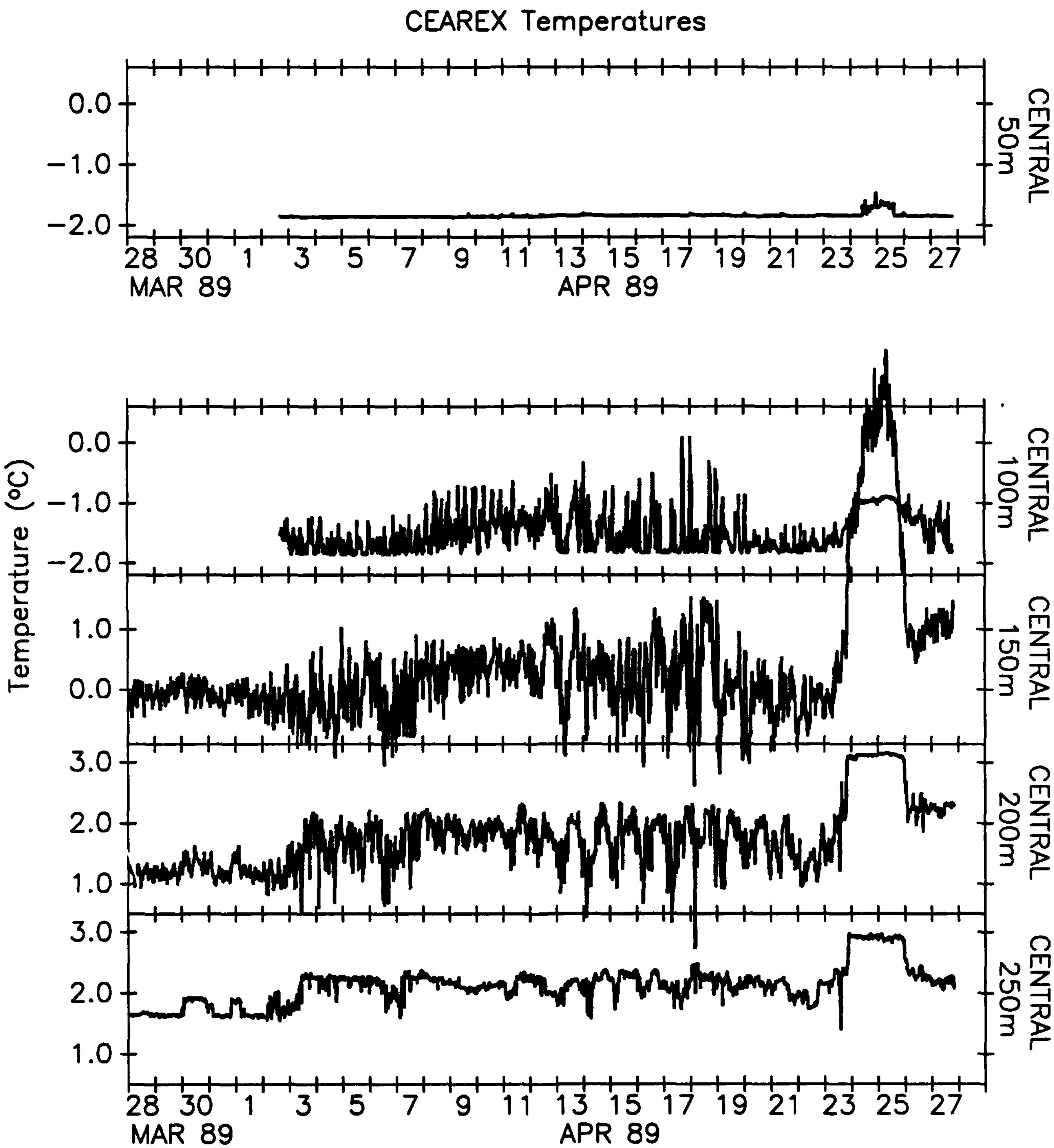

CEAREX Lowpass Filtered Velocities at 100m
Velocity (cm/s)
15.0
0.0
−15.0
CENTRAL U
OUTER−1 U
OUTER−2 U
OUTER−3 U
CENTRAL V
OUTER−1 V
OUTER−2 V
OUTER−3 V
30
1
3
5
7
9
11
13
15
17
19
21
23
25
27
MAR 89
APR 89

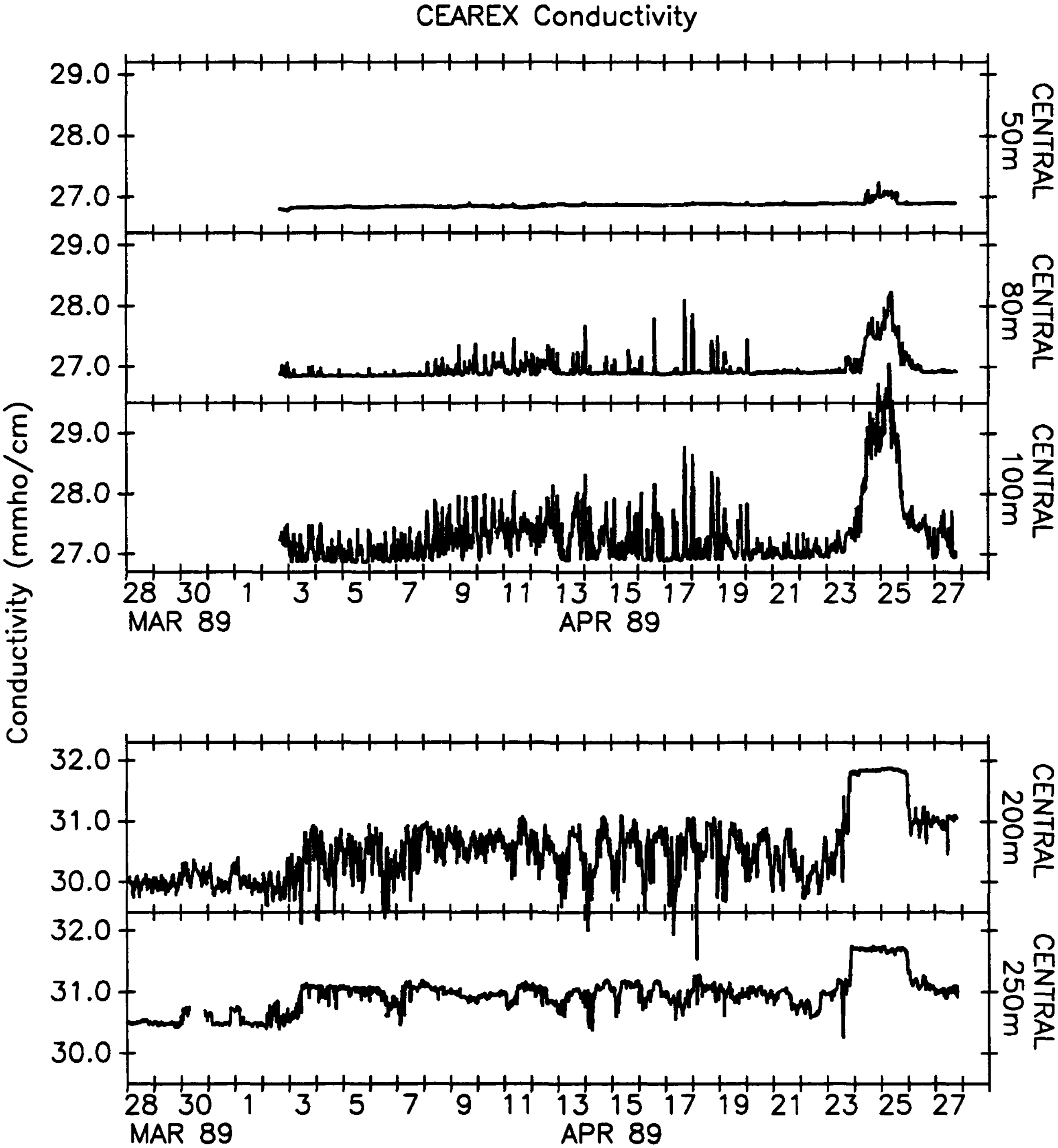
TIME SERIES AT CENTRAL SITE: LOW-PASS FILTERED

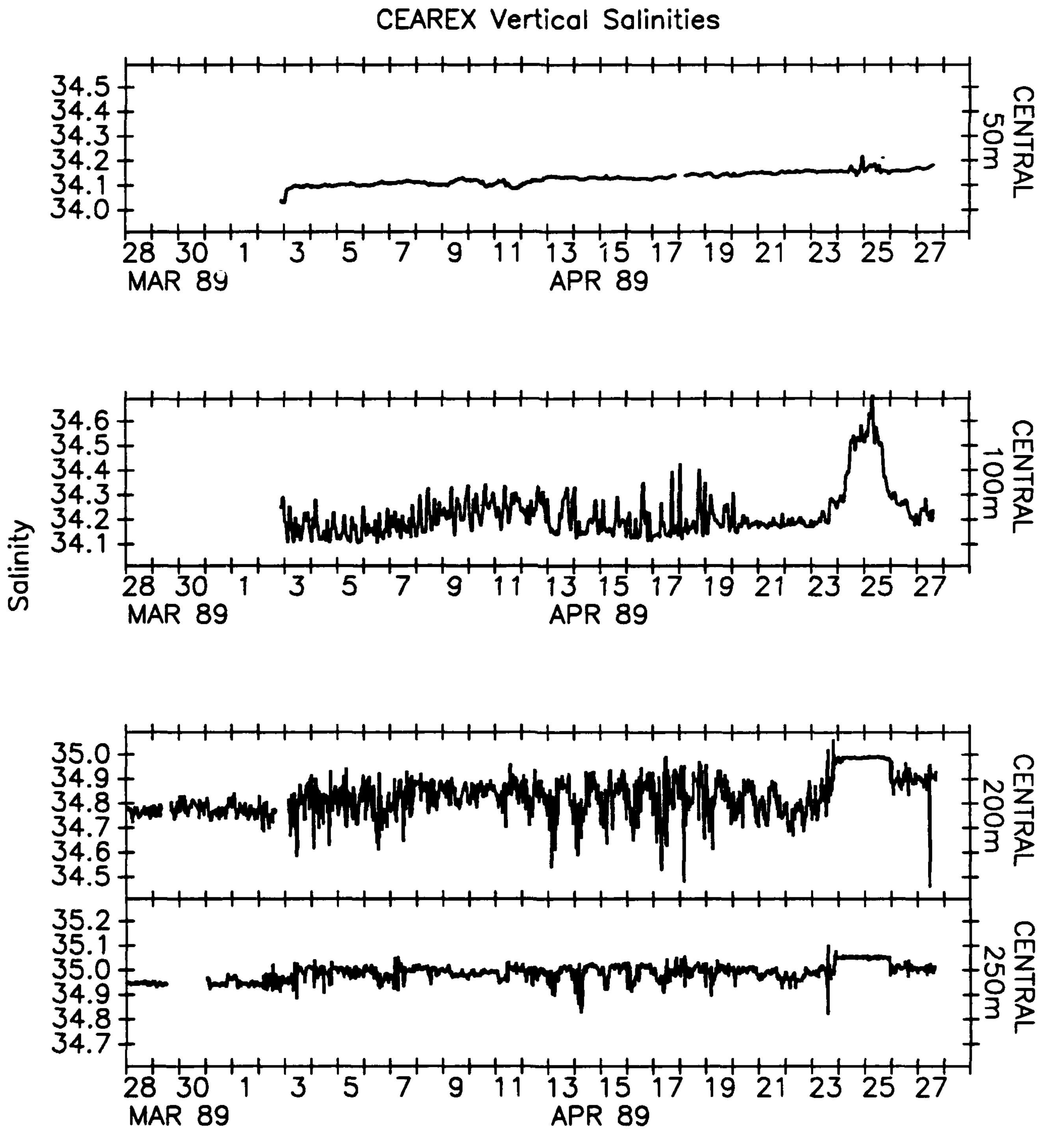
The following seven plots are observations of temperature, conductivity, salinity and velocity from the Central site. Temperature and conductivity observations at 50, 80, and 100 m are from individual SeaBird sensors; data from 150, 200, and 250 m are from Seacat temperature-conductivity recorders. The shorter velocity records at 25, 50, 75, and 150 m are from the ADCP; the data from 100, 200, and 250 m are from S-4s. Vertical shear is defined as

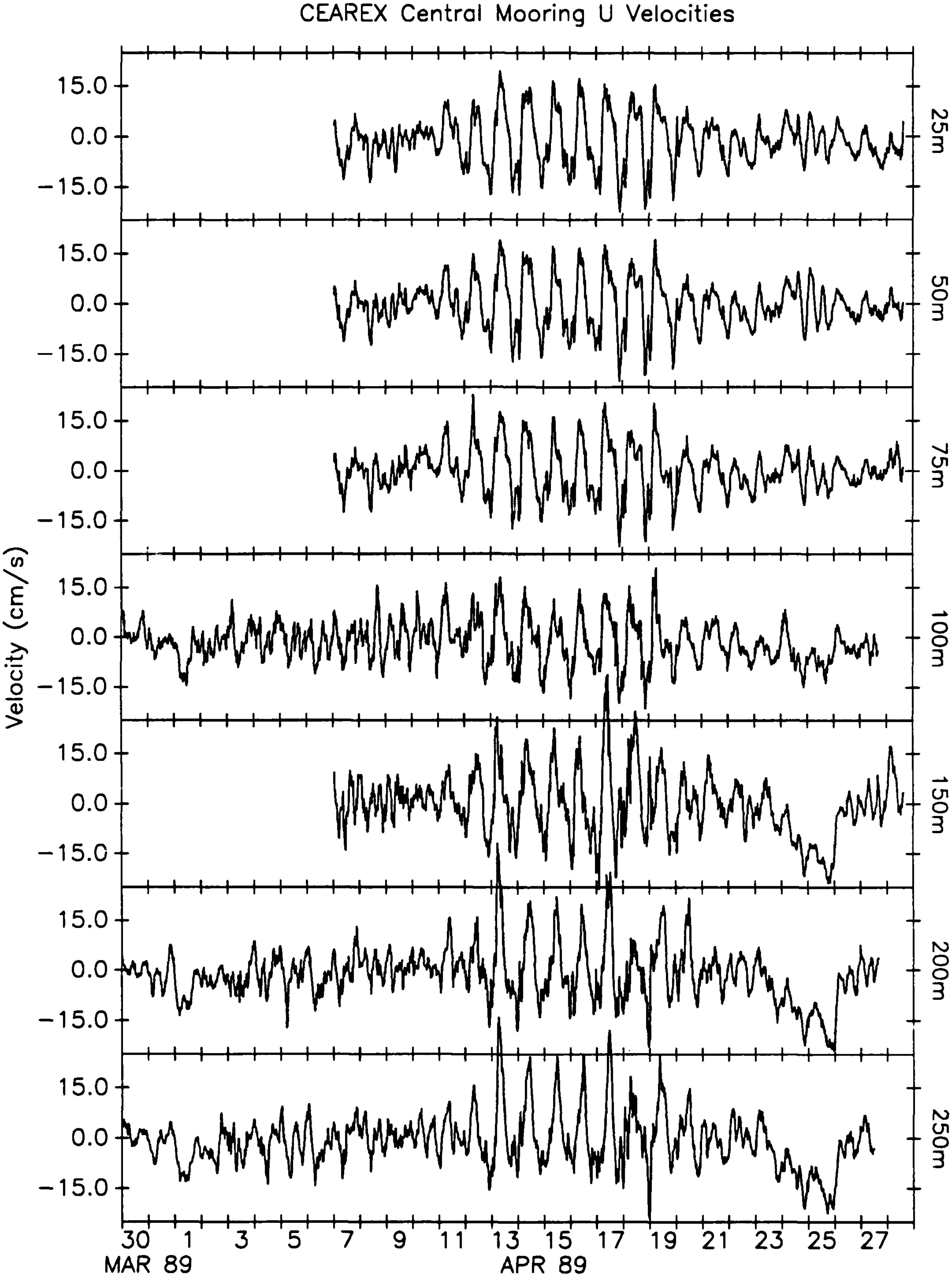
$$\frac{\vec{u}_{shallower} - \vec{u}_{deeper}}{25m}$$

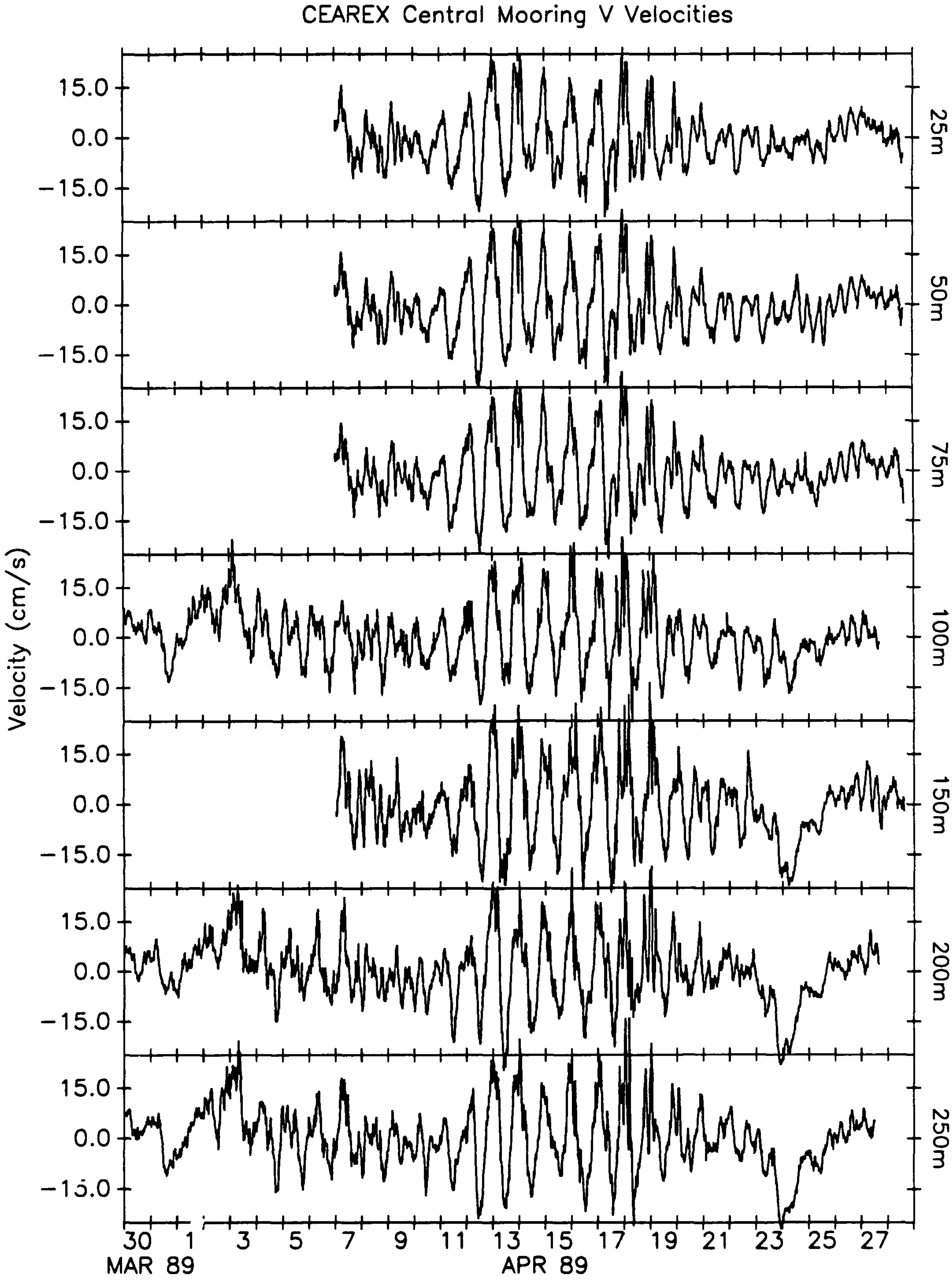
are from observations made by the ADCP. Note: absolute velocities are presented after the start of April 4; relative velocities are shown before. (See Tables 1,2 and 3.)

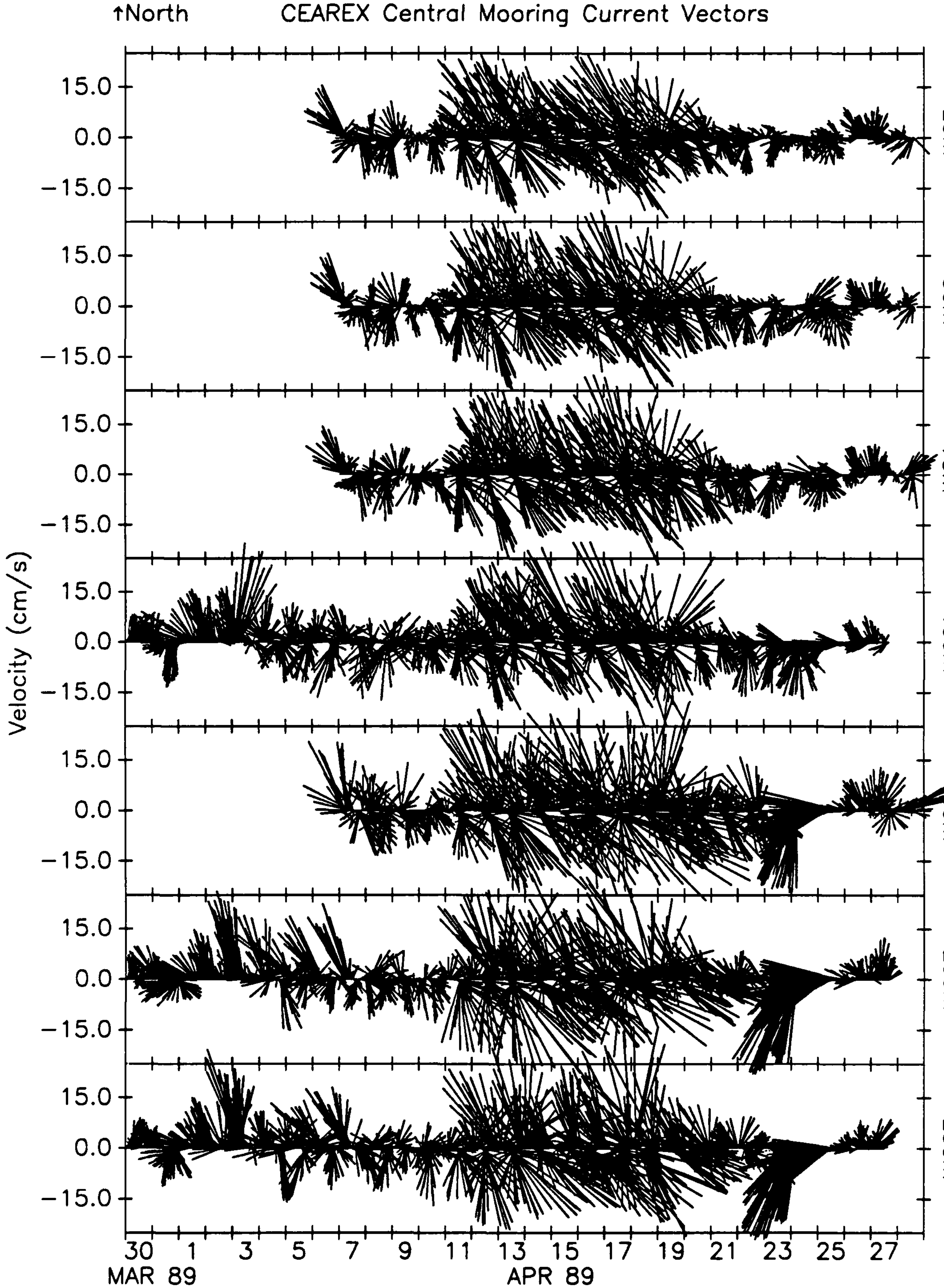

CEAREX Temperatures
0.0
-1.0
-2.0
CENTRAL 50m
28 30 1 3 5 7 9 11 13 15 17 19 21 23 25 27
MAR 89
APR 89
Temperature (°C)
CENTRAL 100m
1.0
CENTRAL 150m
3.0
2.0
CENTRAL 200m
CENTRAL 250m


CEAREX Conductivity
Conductivity (mmho/cm)
CENTRAL 50m
CENTRAL 80m
CENTRAL 100m
CENTRAL 200m
CENTRAL 250m
29.0
28.0
27.0
32.0
31.0
30.0
28 30 1 3 5 7 9 11 13 15 17 19 21 23 25 27
MAR 89
APR 89

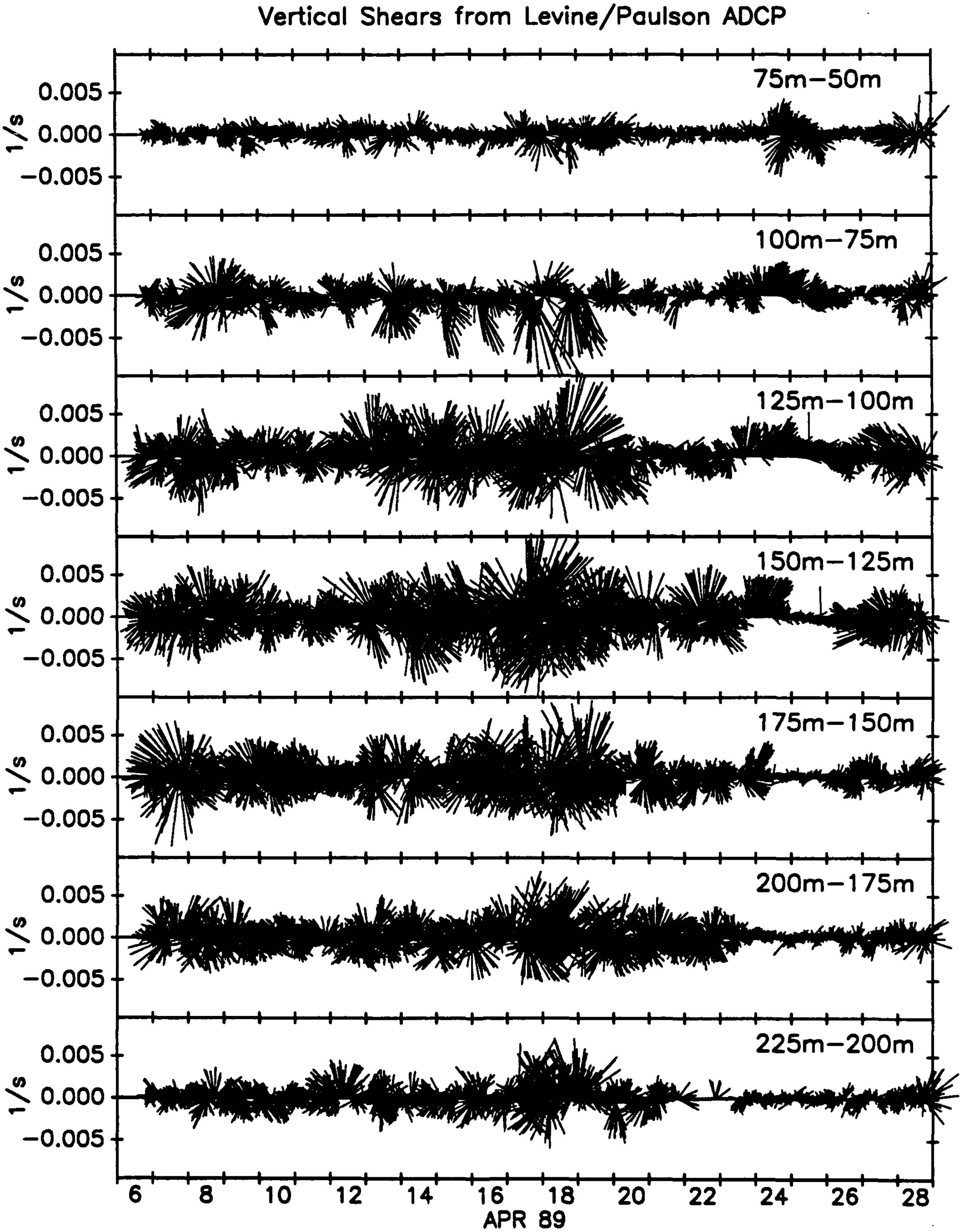

CEAREX Vertical Salinities
Salinity
34.5
34.4
34.3
34.2
34.1
34.0
CENTRAL 50m
34.6
34.5
34.4
34.3
34.2
34.1
CENTRAL 100m
35.0
34.9
34.8
34.7
34.6
34.5
CENTRAL 200m
35.2
35.1
35.0
34.9
34.8
34.7
CENTRAL 250m
28 30 1 3 5 7 9 11 13 15 17 19 21 23 25 27
MAR 89
APR 89


CEAREX Central Mooring U Velocities
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
30
1
3
5
7
9
11
13
15
17
19
21
23
25
27
MAR 89
APR 89


CEAREX Central Mooring V Velocities
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
30
1
3
5
7
9
11
13
15
17
19
21
23
25
27
MAR 89
APR 89



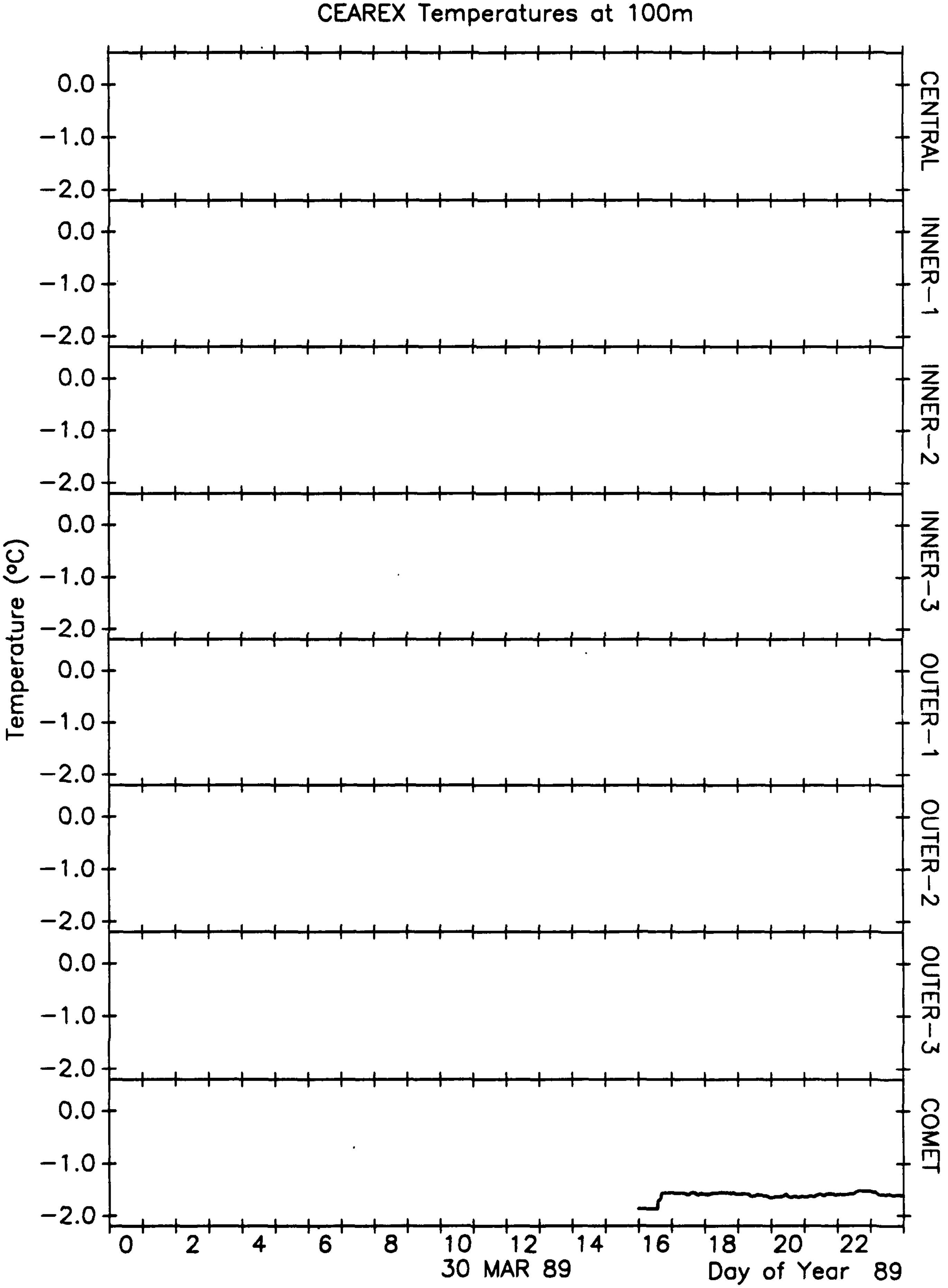
↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
200m
250m
30
1
3
5
7
9
11
13
15
17
19
21
23
25
27
MAR 89
APR 89



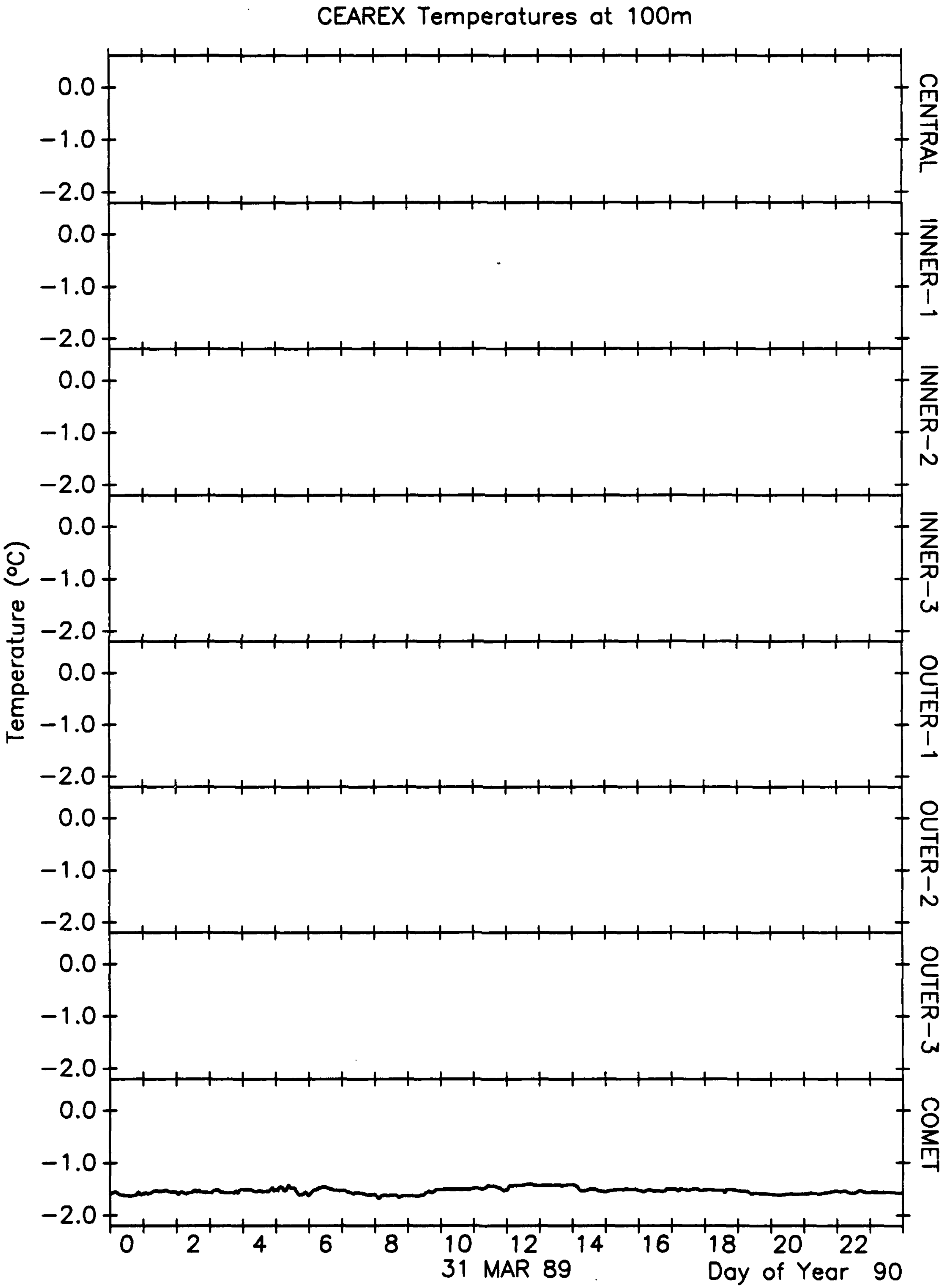
Vertical Shears from Levine/Paulson ADCP
75m−50m
100m−75m
125m−100m
150m−125m
175m−150m
200m−175m
225m−200m
0.005
0.000
−0.005
1/s
6
8
10
12
14
16
18
20
22
24
26
28
APR 89

TIME SERIES OF TEMPERATURE AT 100 m: UNFILTERED

On the following 29 pages are observations of temperature at 100 m depth from the Central, I1, I2, I3, O1, O2, O3 and Comet moorings.

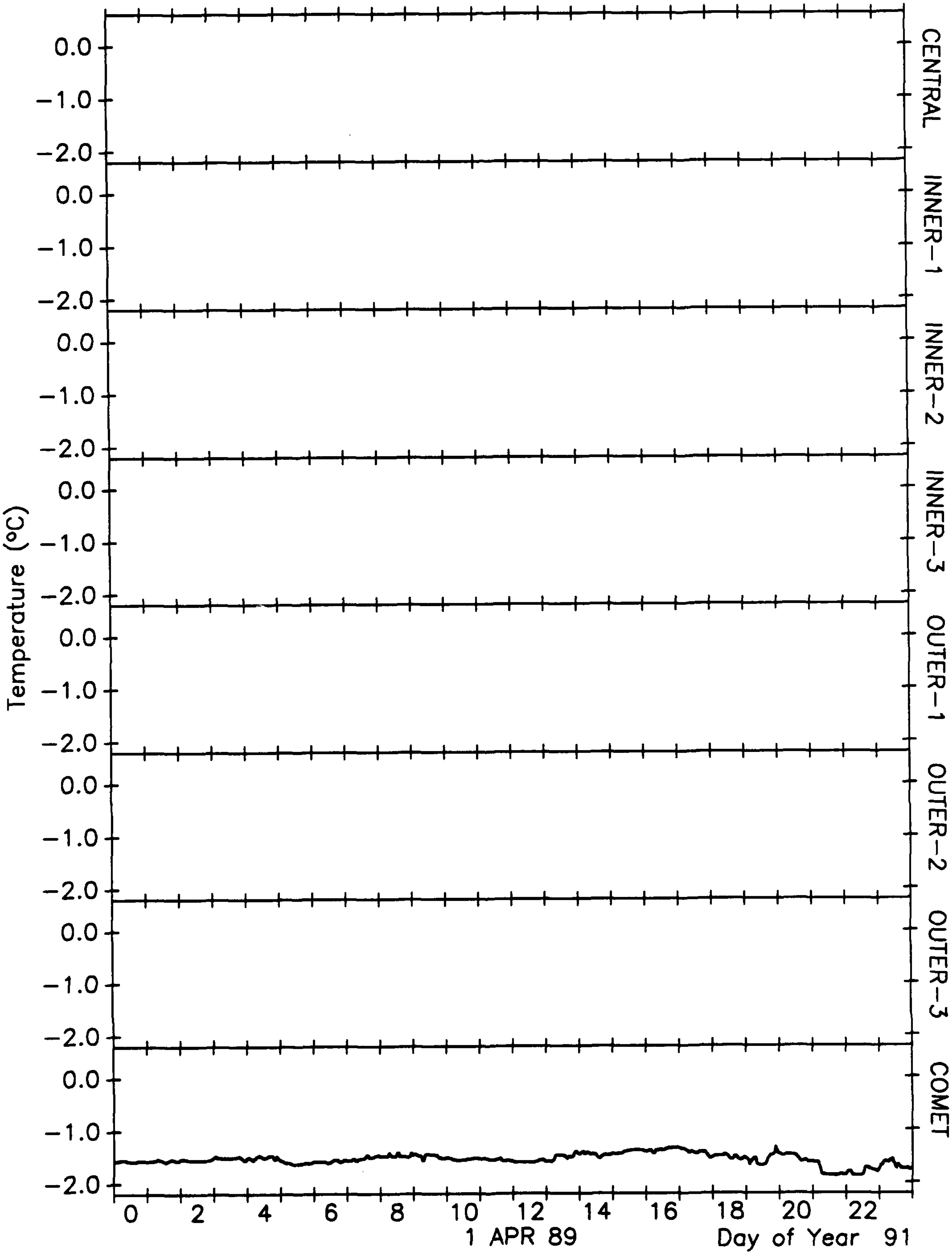


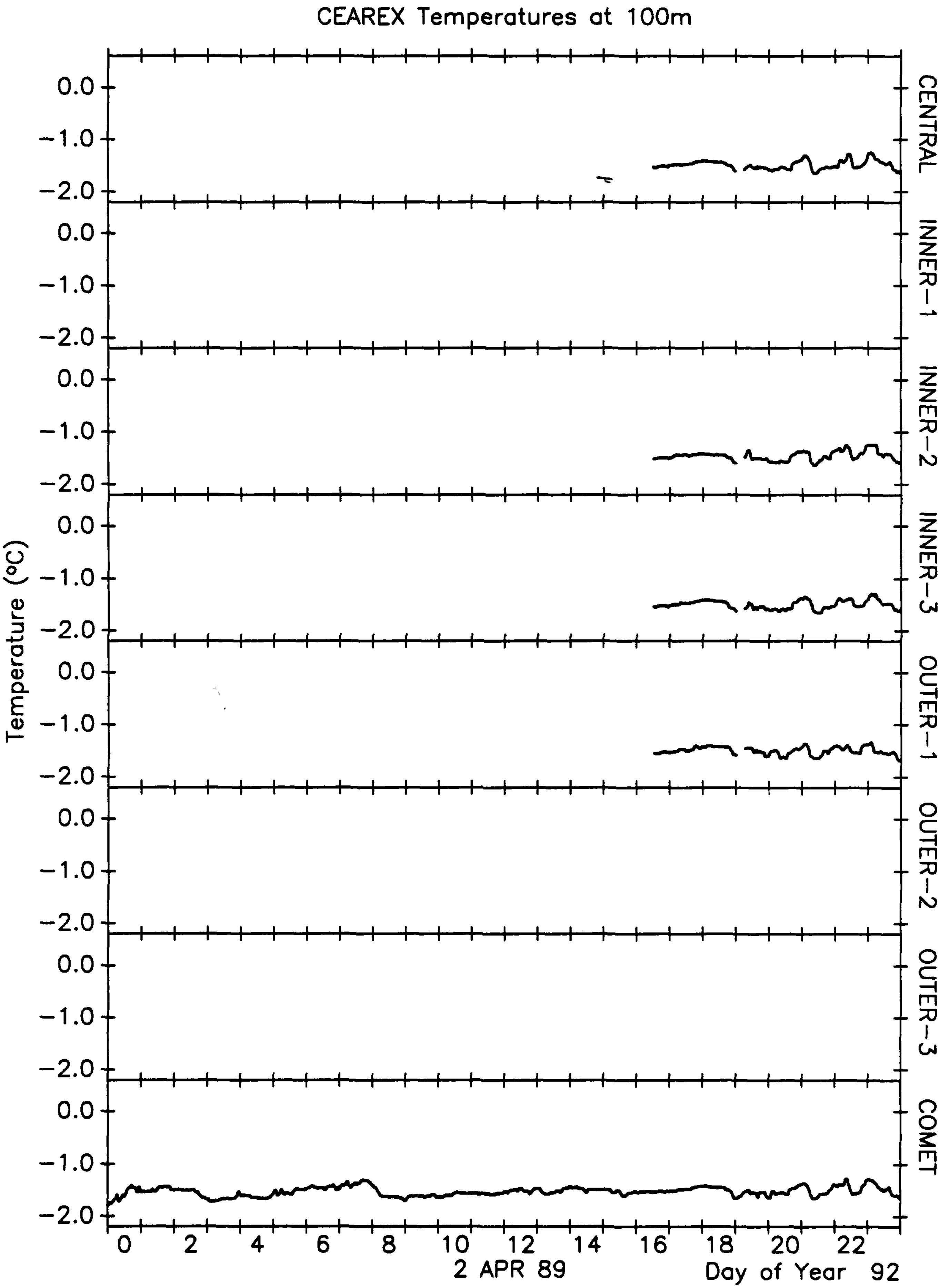
CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
30 MAR 89
Day of Year 89



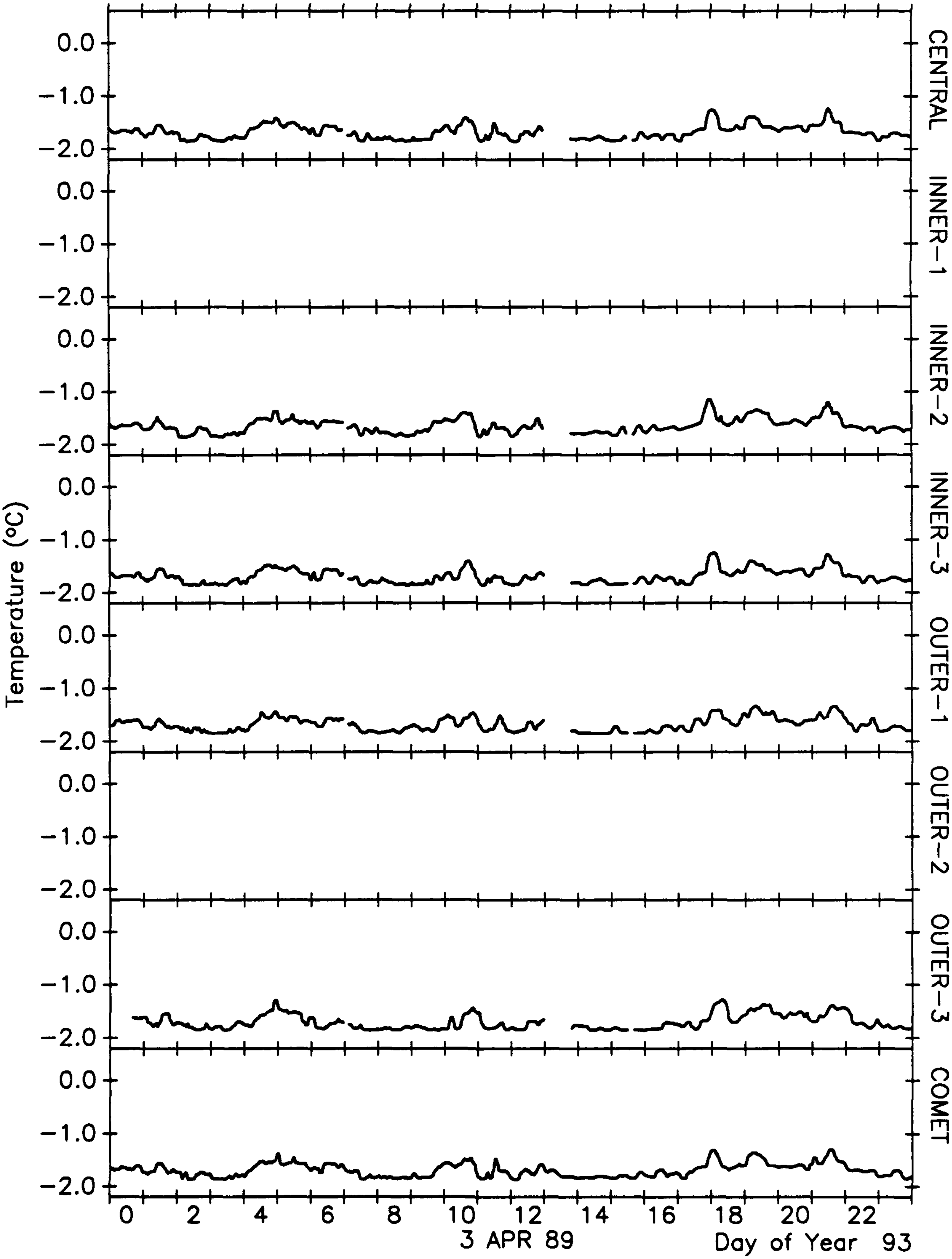
CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
31 MAR 89
Day of Year 90

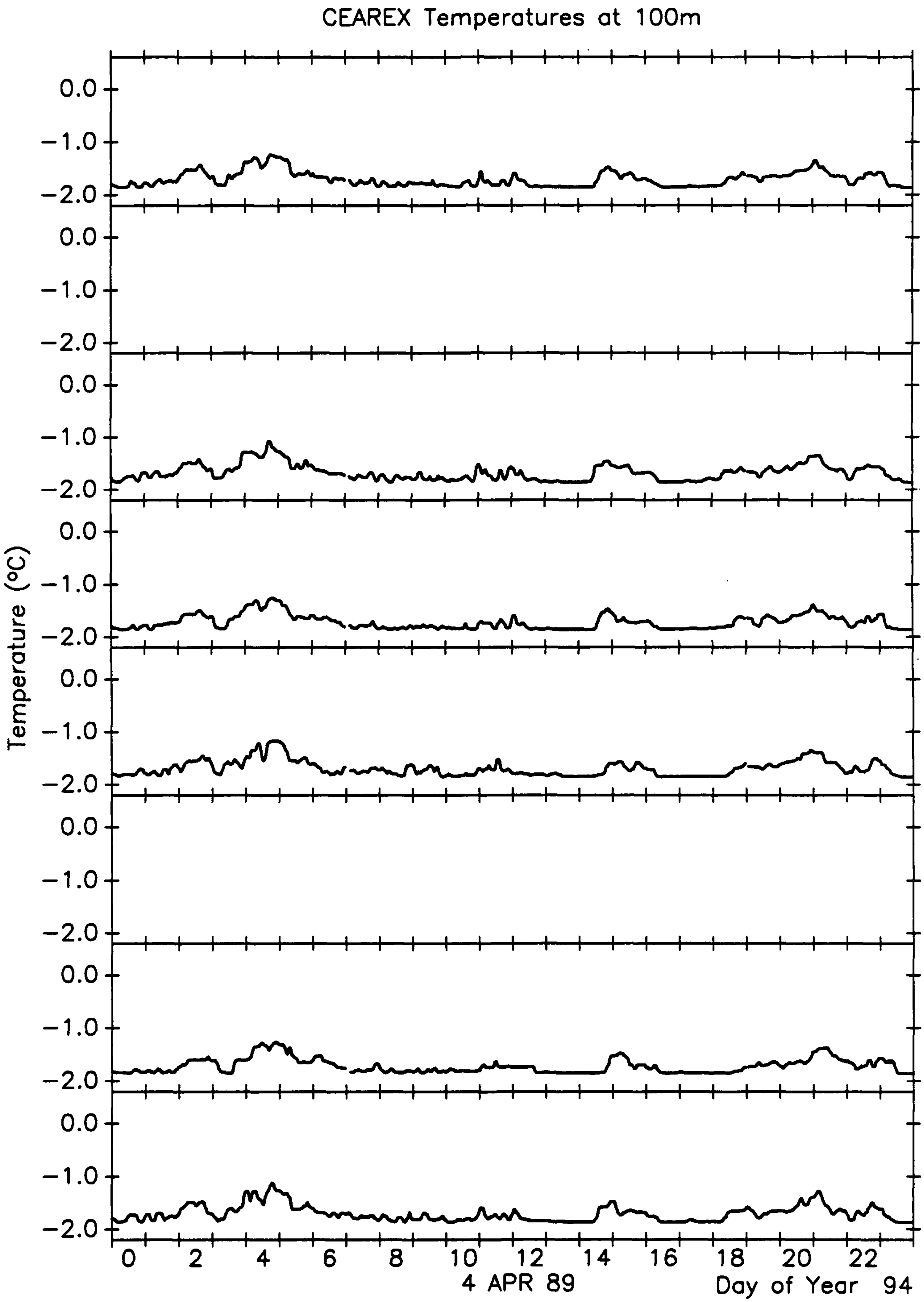
CEAREX Temperatures at 100m

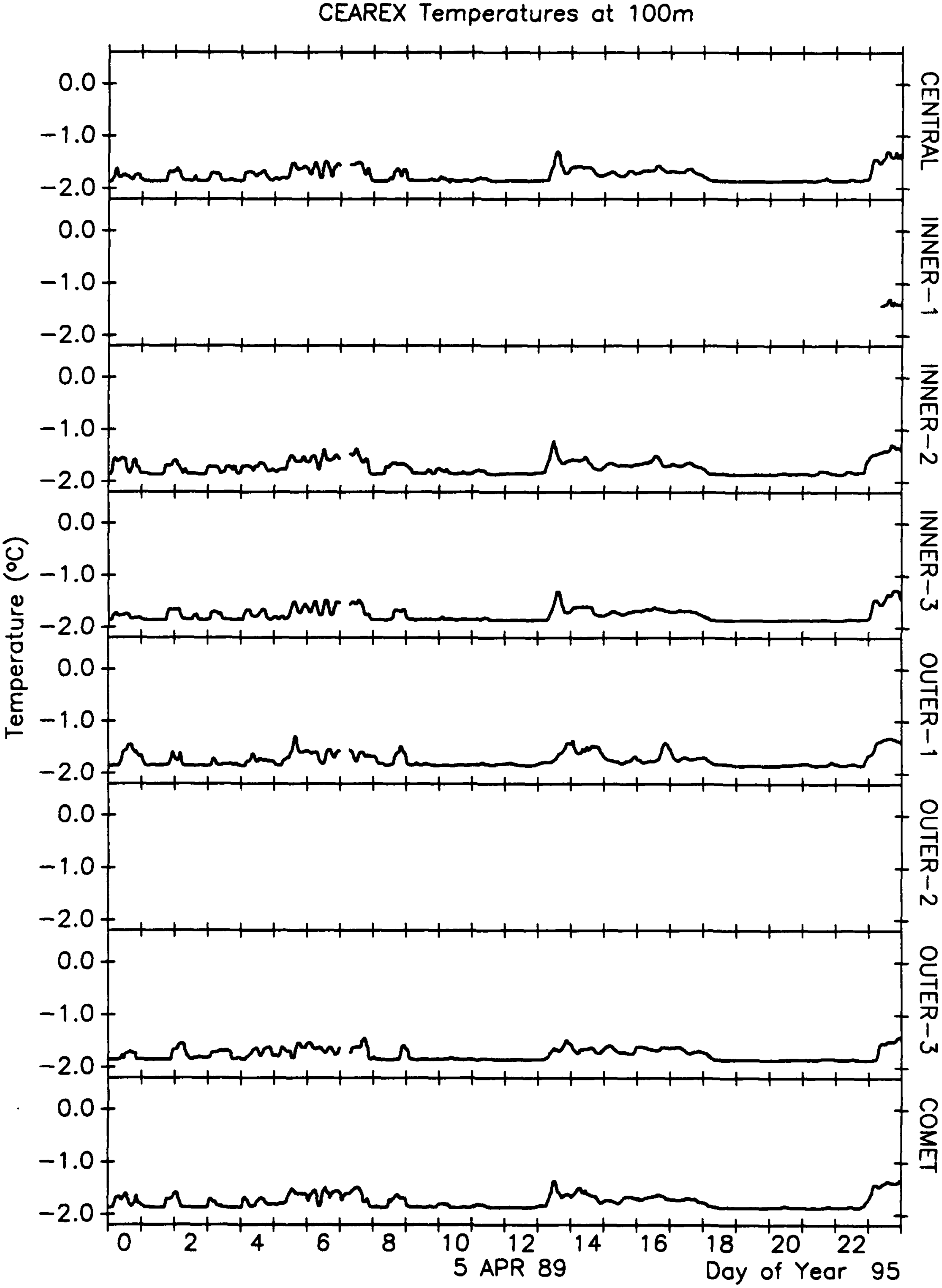


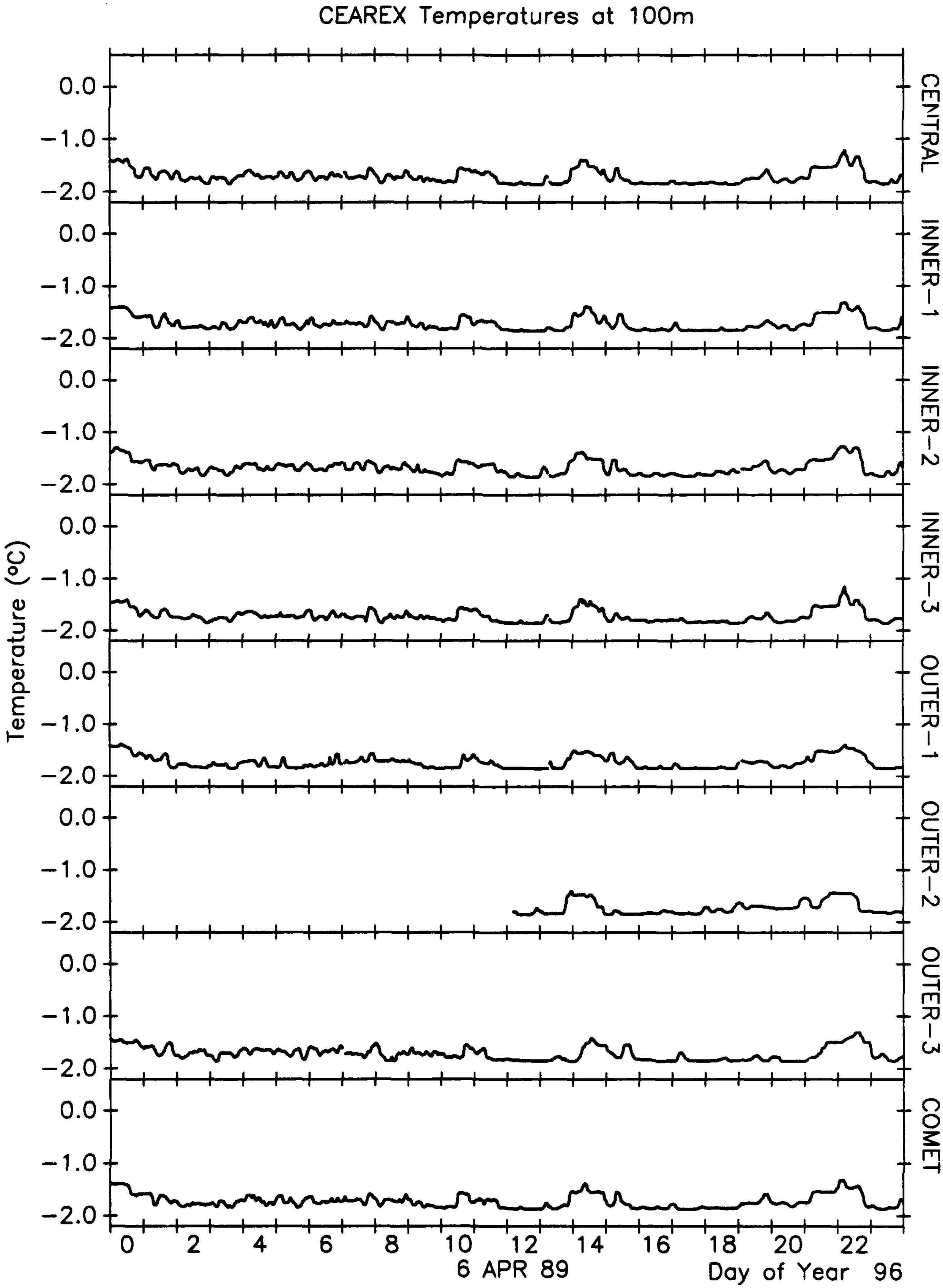

CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
2 APR 89
Day of Year 92

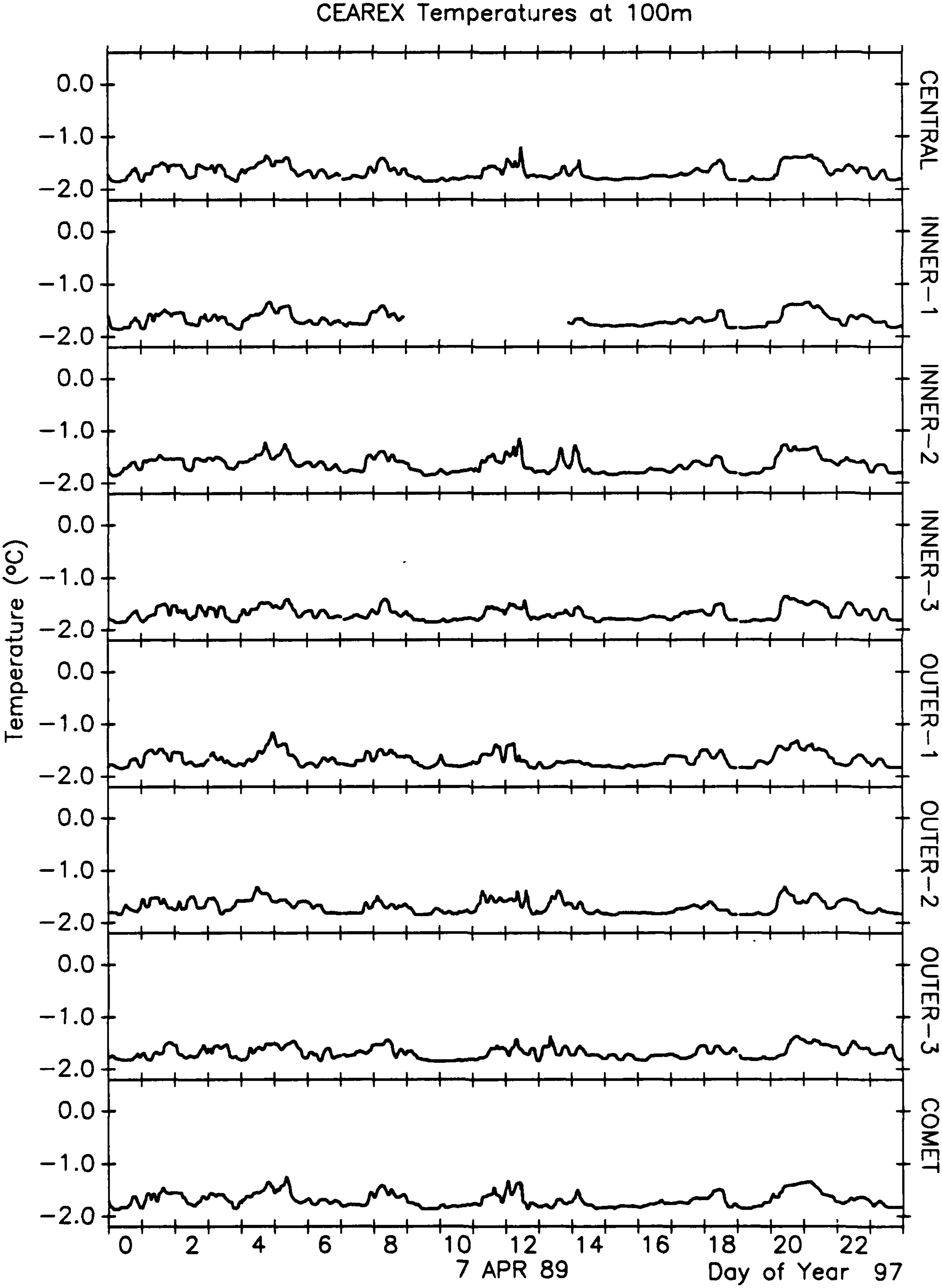
CEAREX Temperatures at 100m

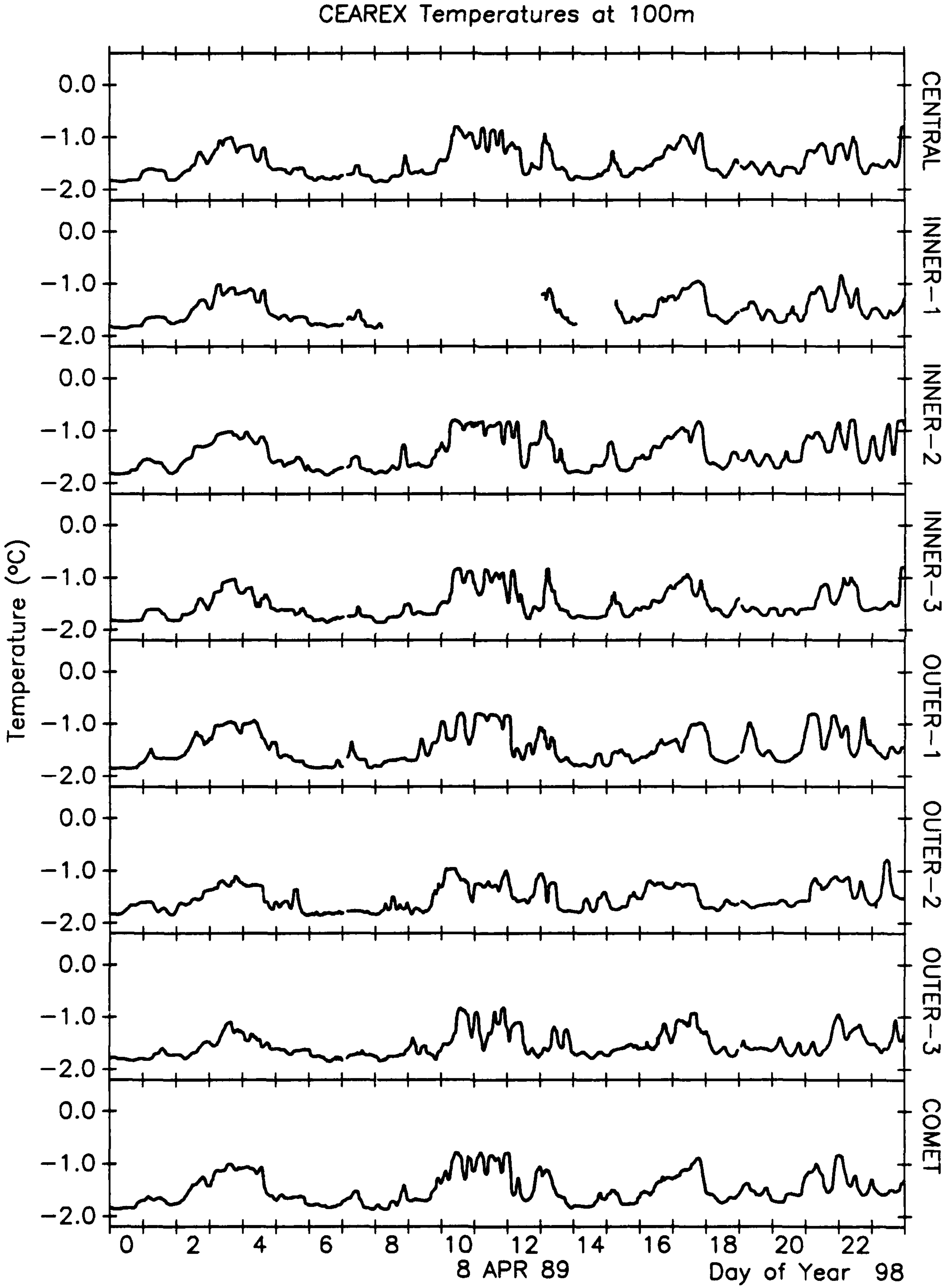


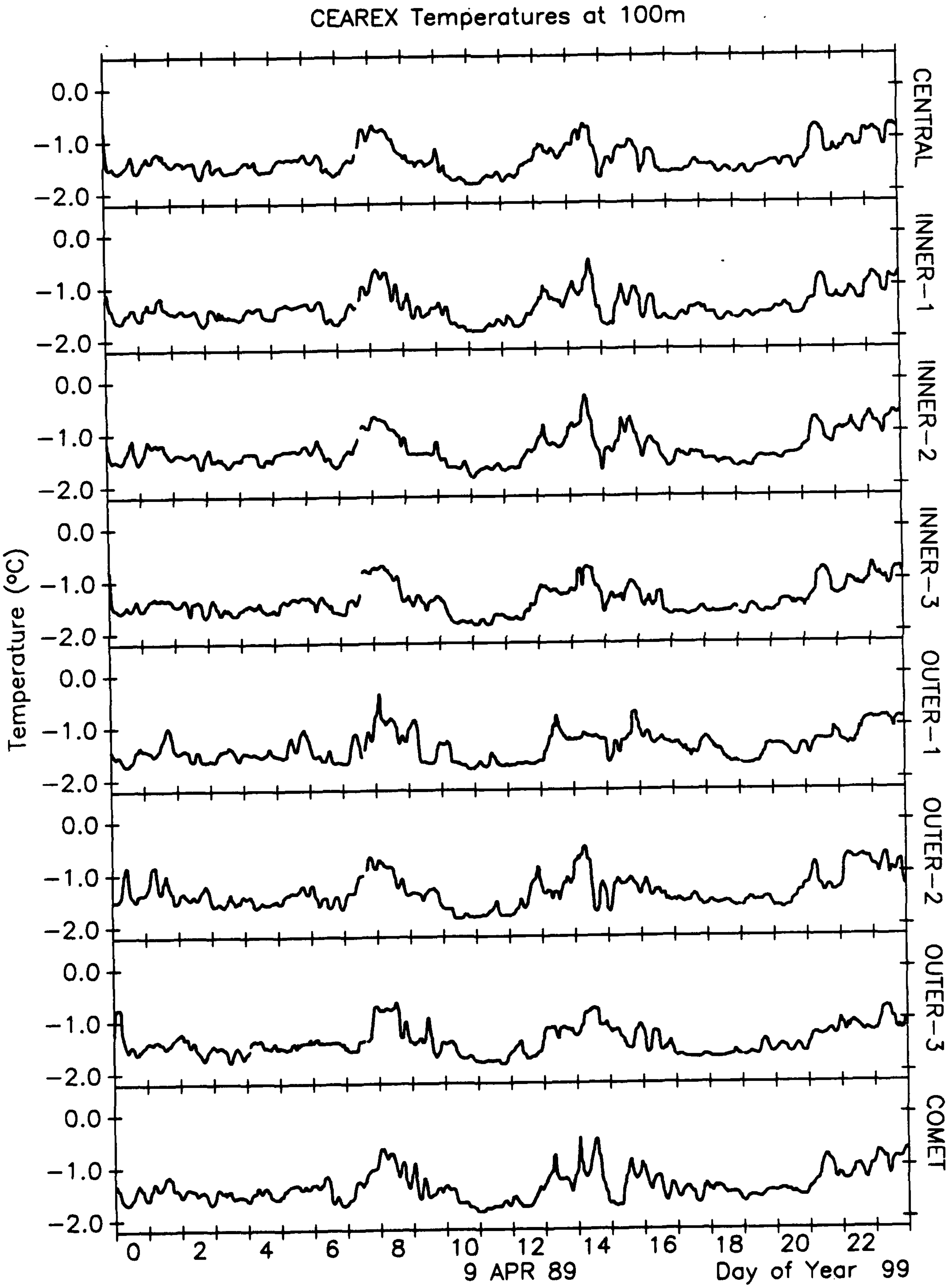

CEAREX Temperatures at 100m
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
Temperature (°C)
0
2
4
6
8
10
12
14
16
18
20
22
4 APR 89
Day of Year 94


CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
5 APR 89
Day of Year 95

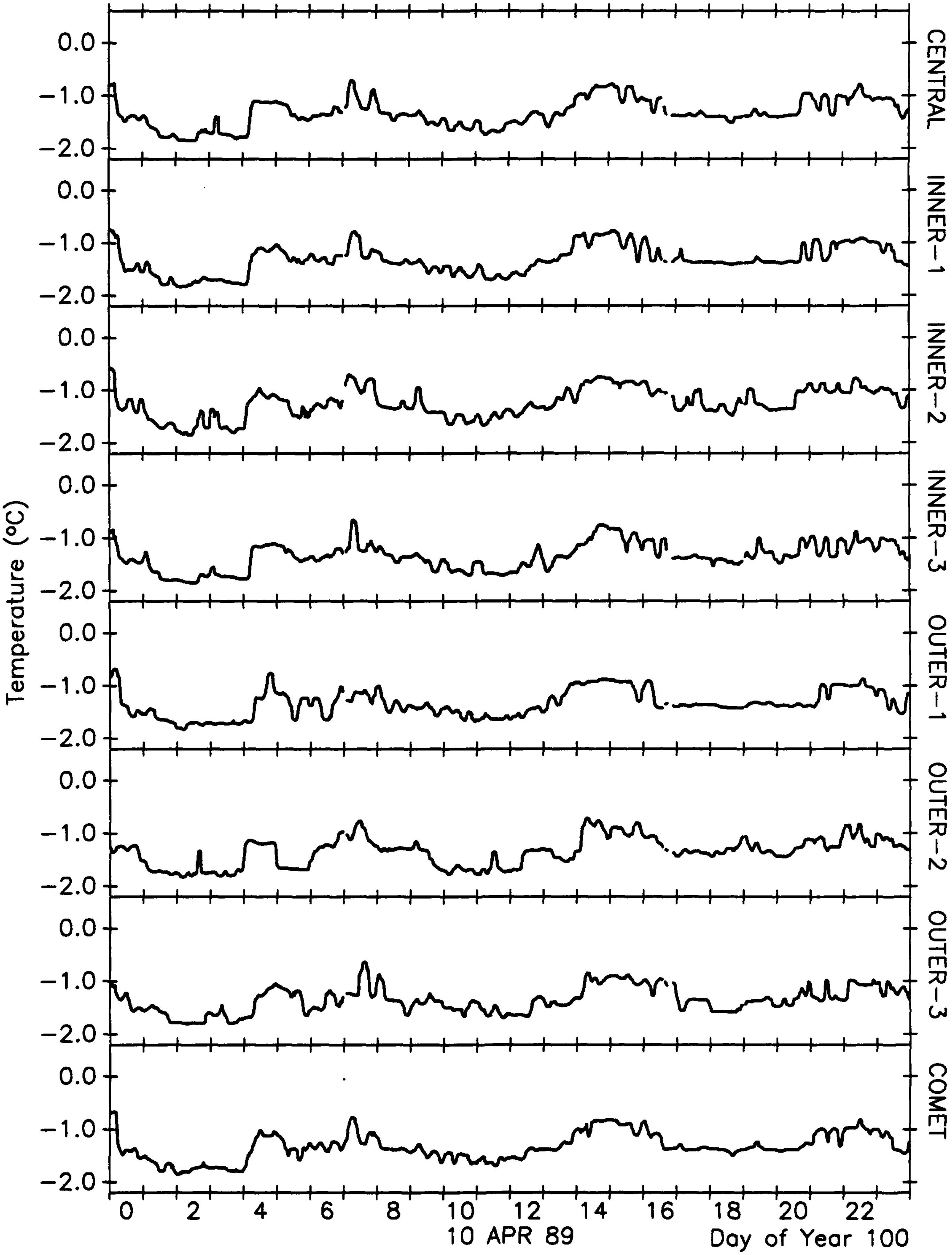

CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
6 APR 89
Day of Year 96


CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
7 APR 89
Day of Year 97

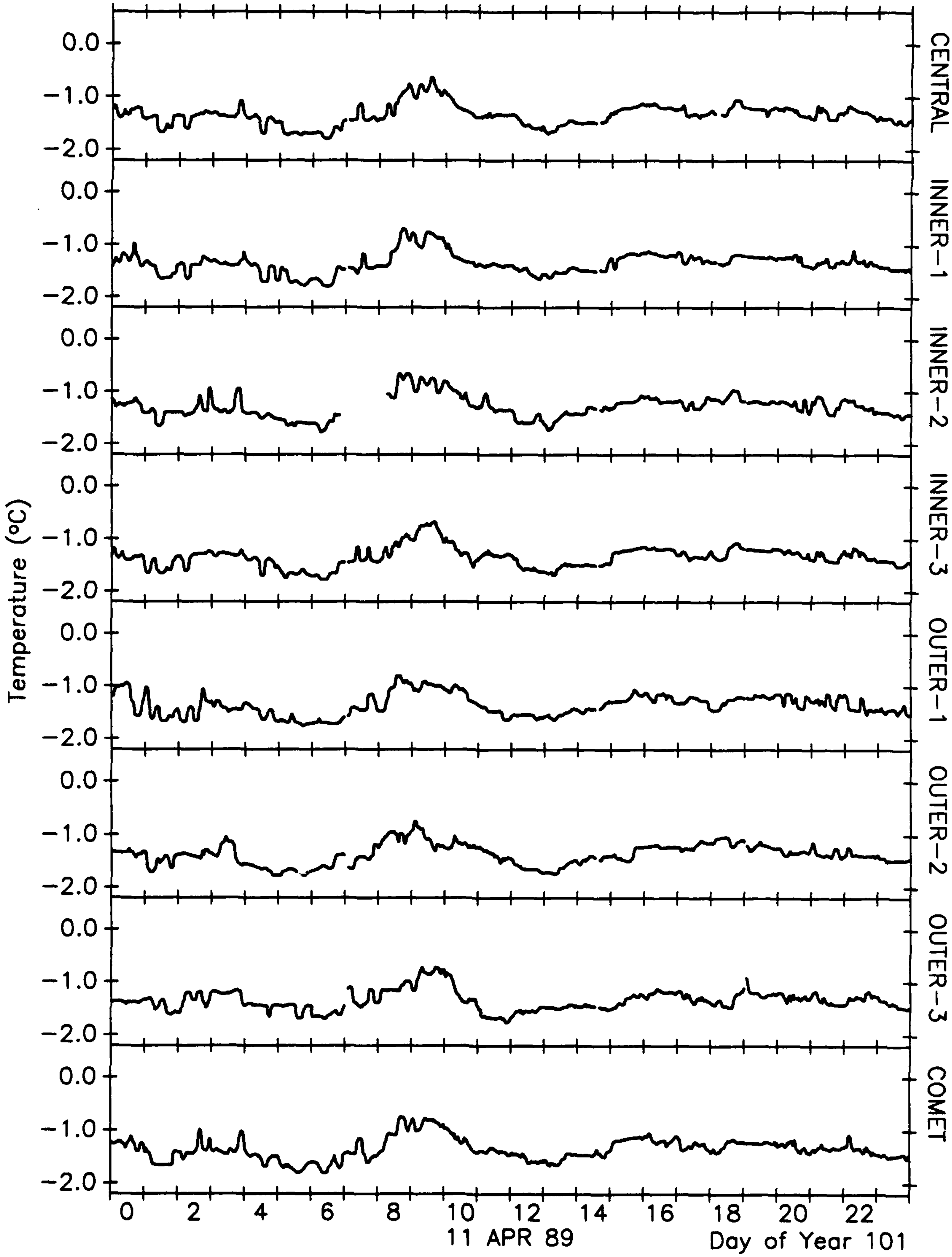

CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0 2 4 6 8 10 12 14 16 18 20 22
8 APR 89
Day of Year 98

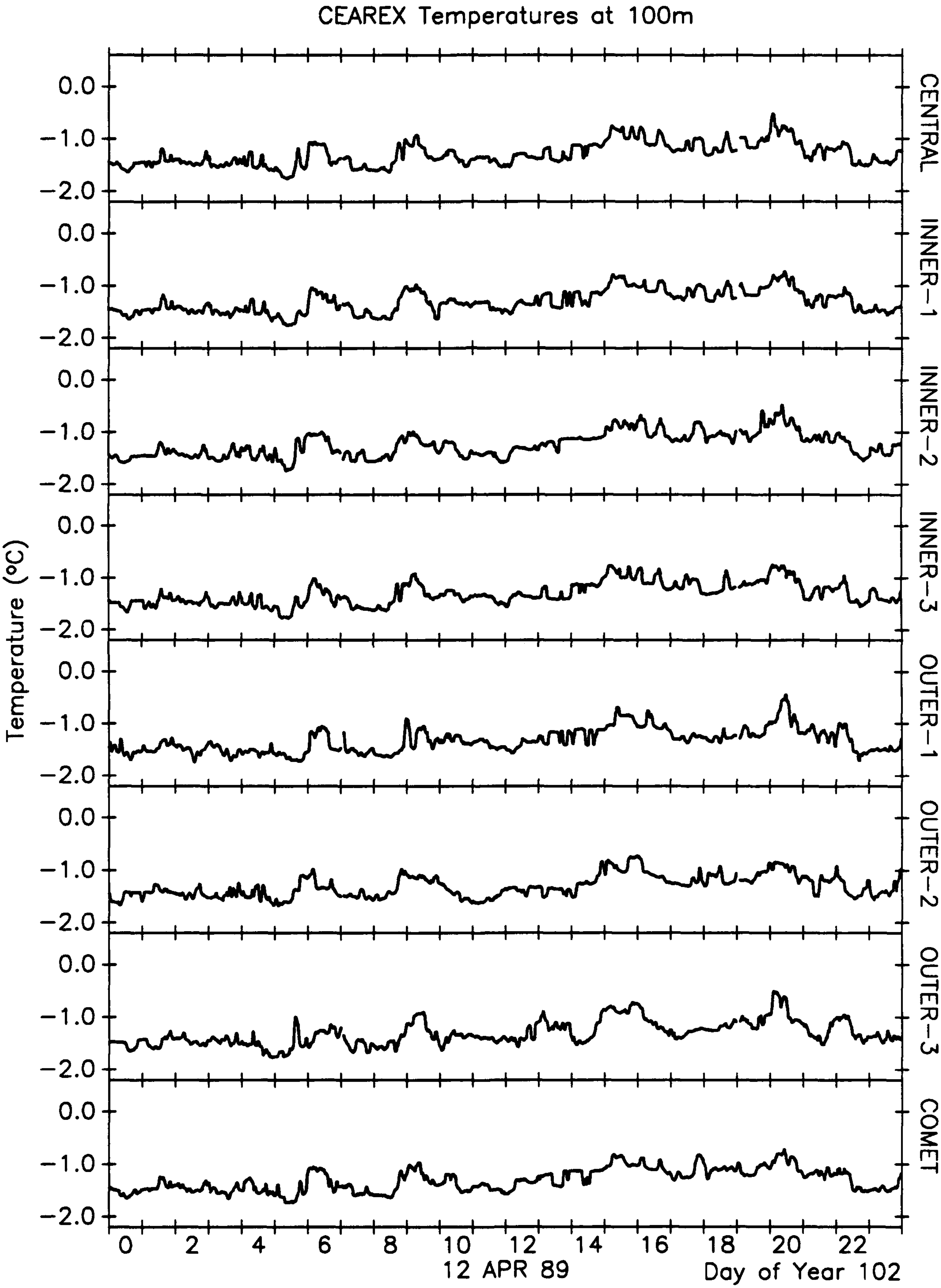

CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
9 APR 89
Day of Year 99

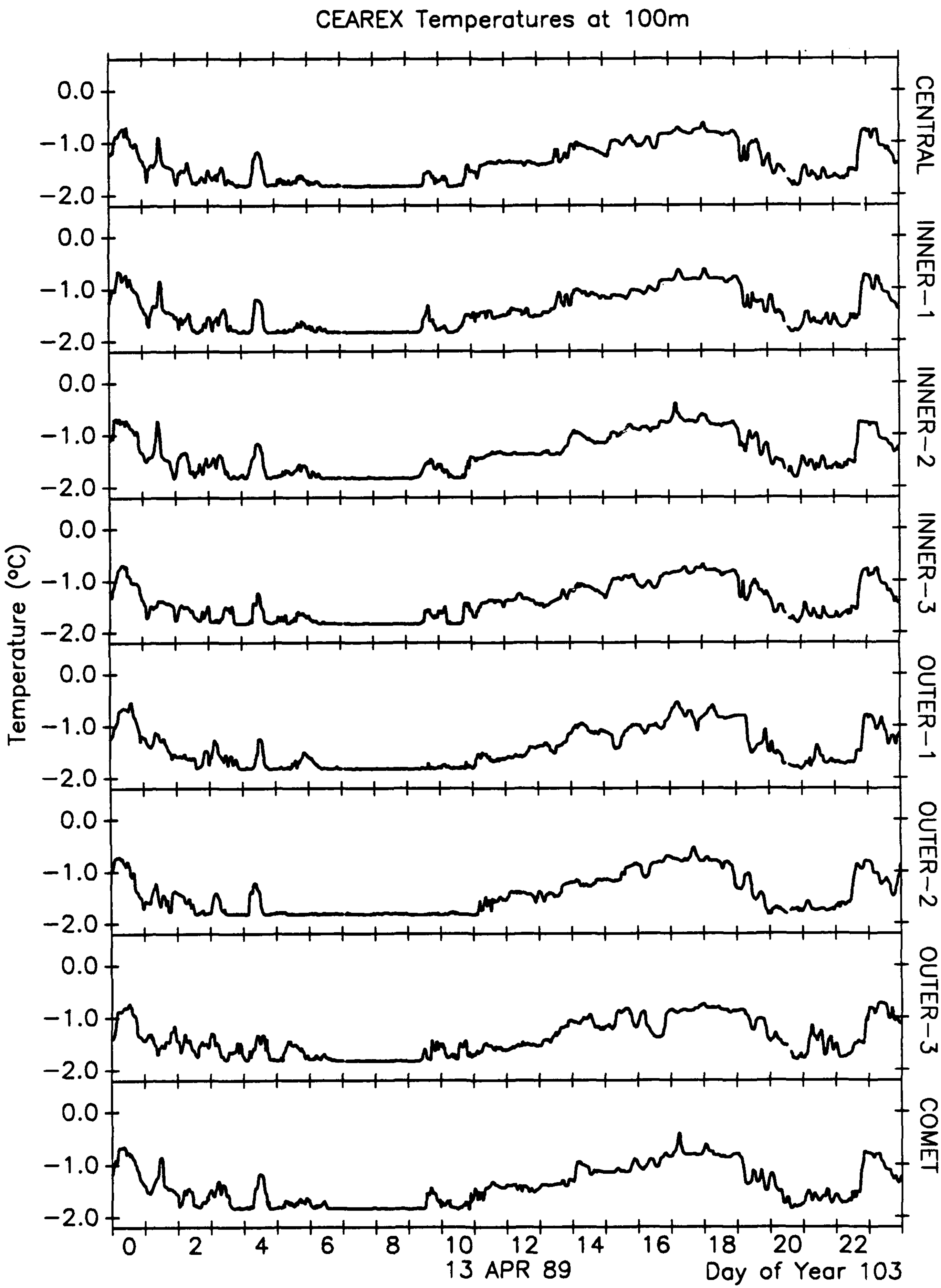
CEAREX Temperatures at 100m

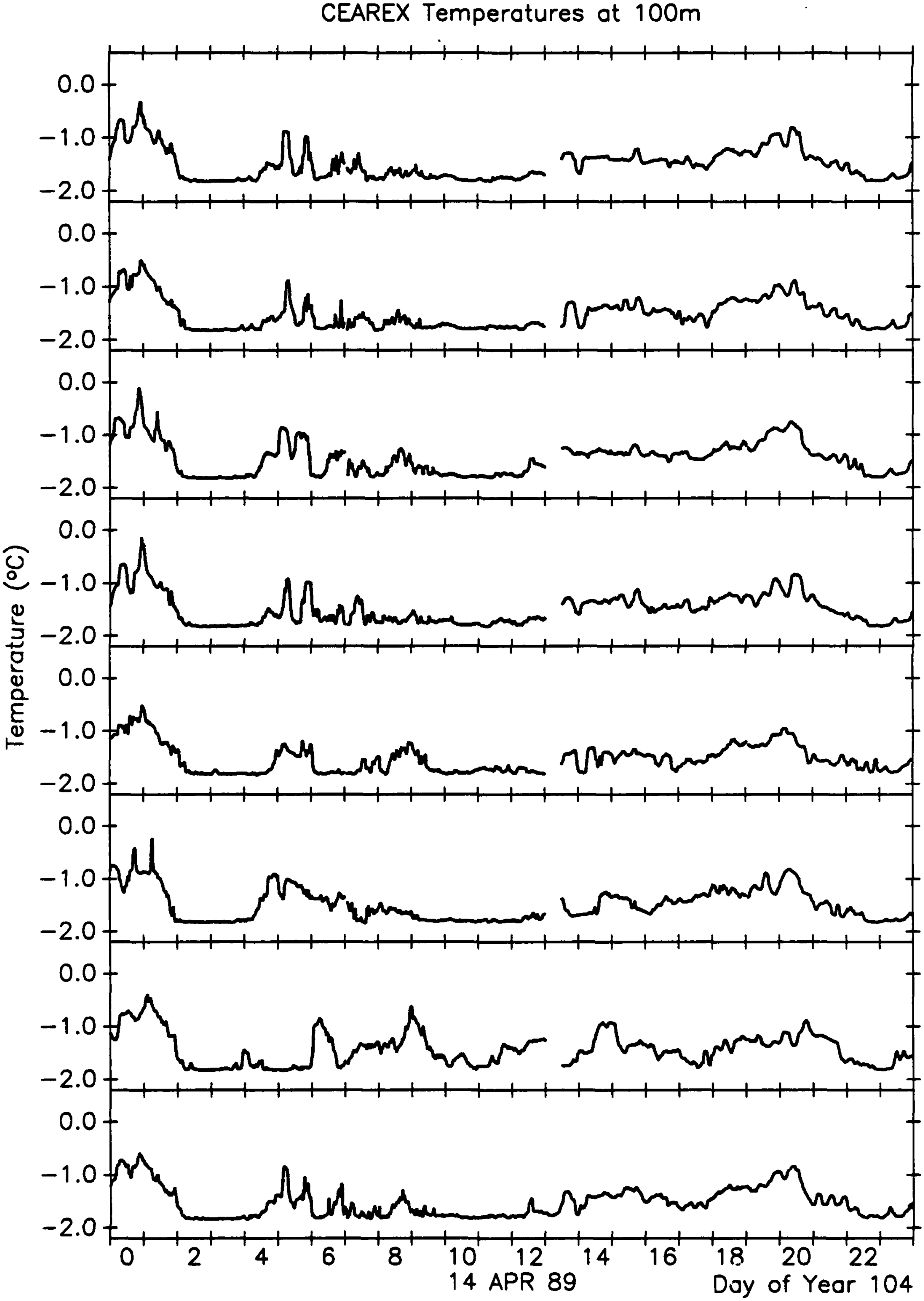


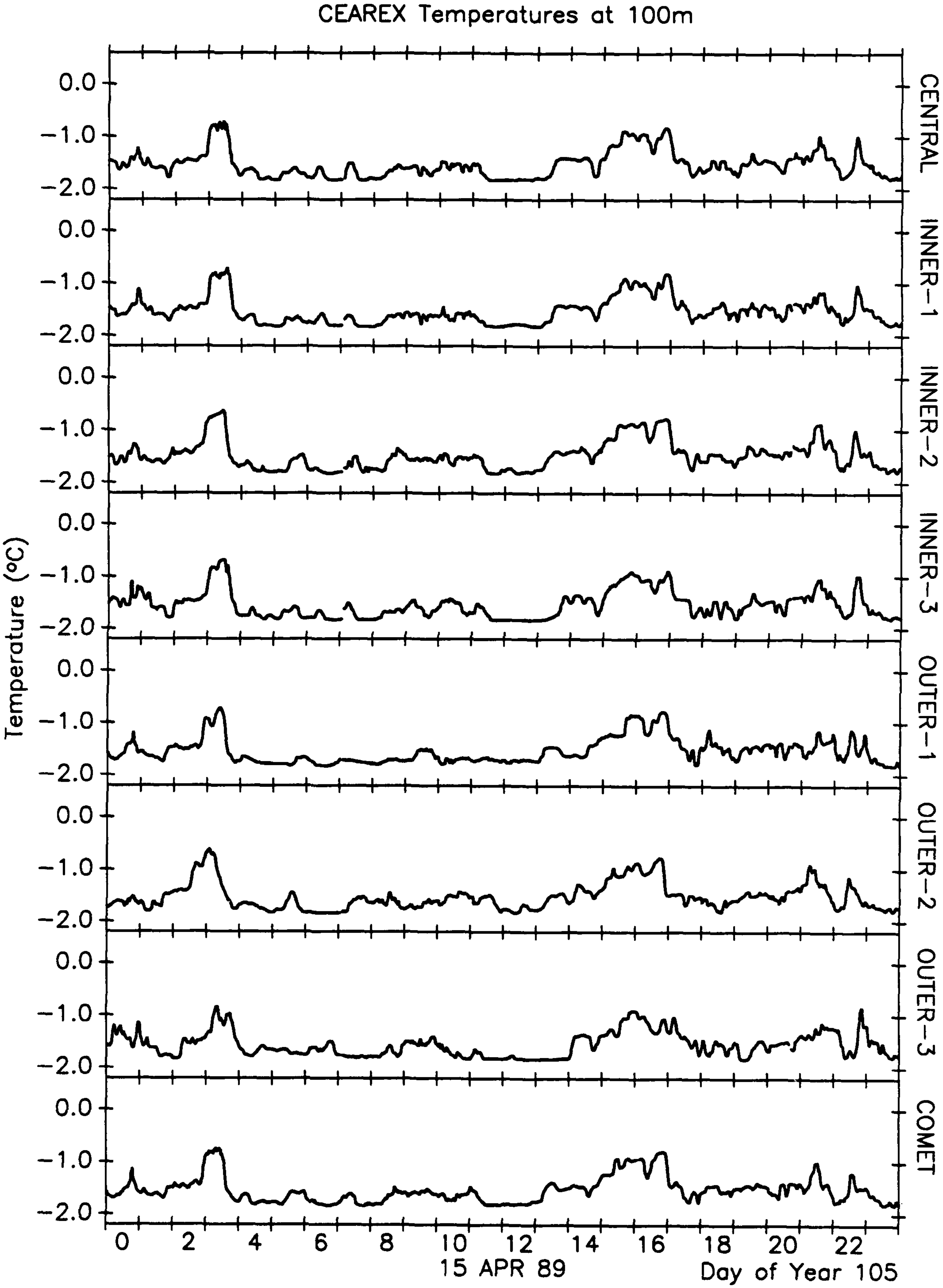
CEAREX Temperatures at 100m

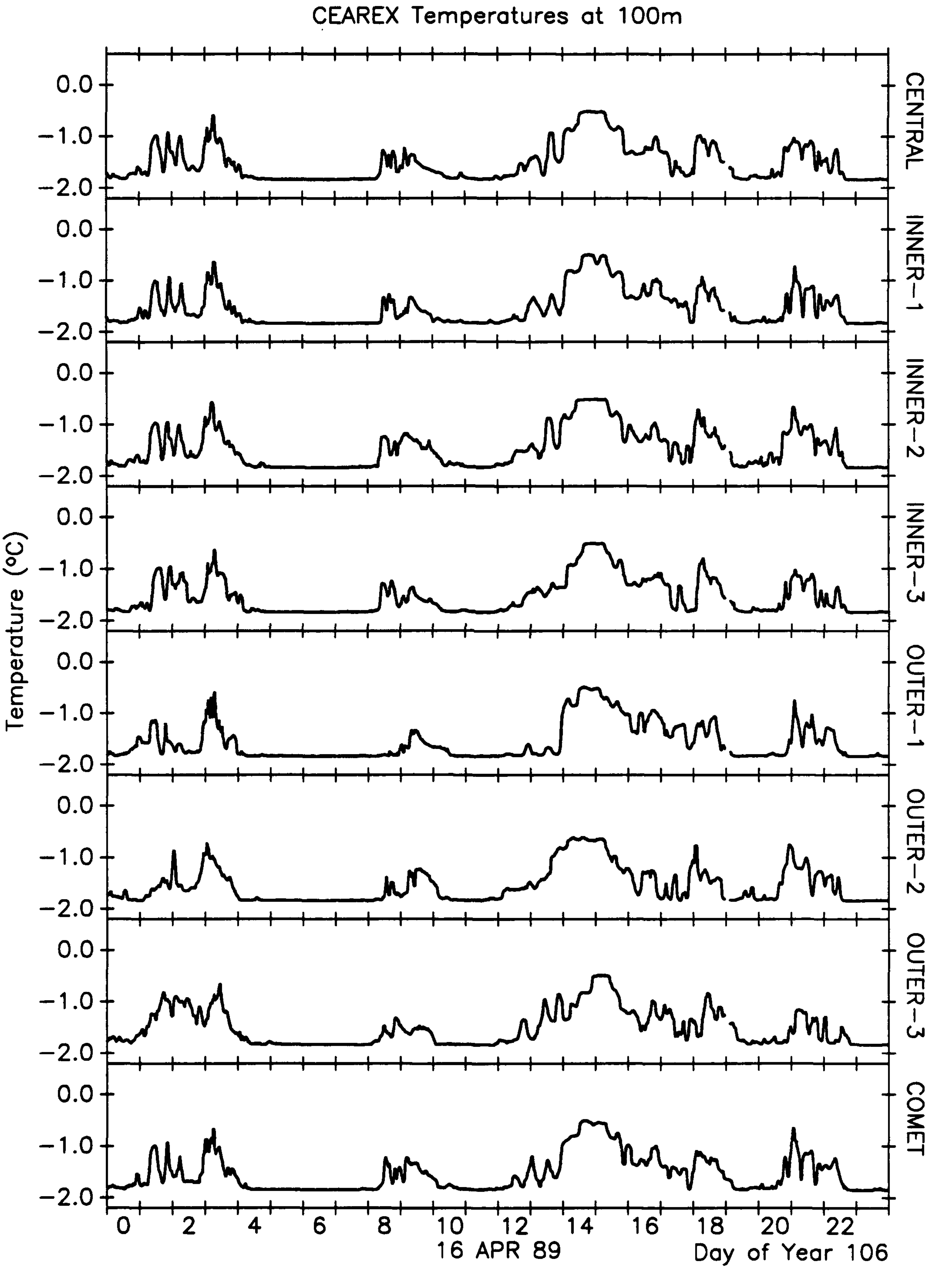


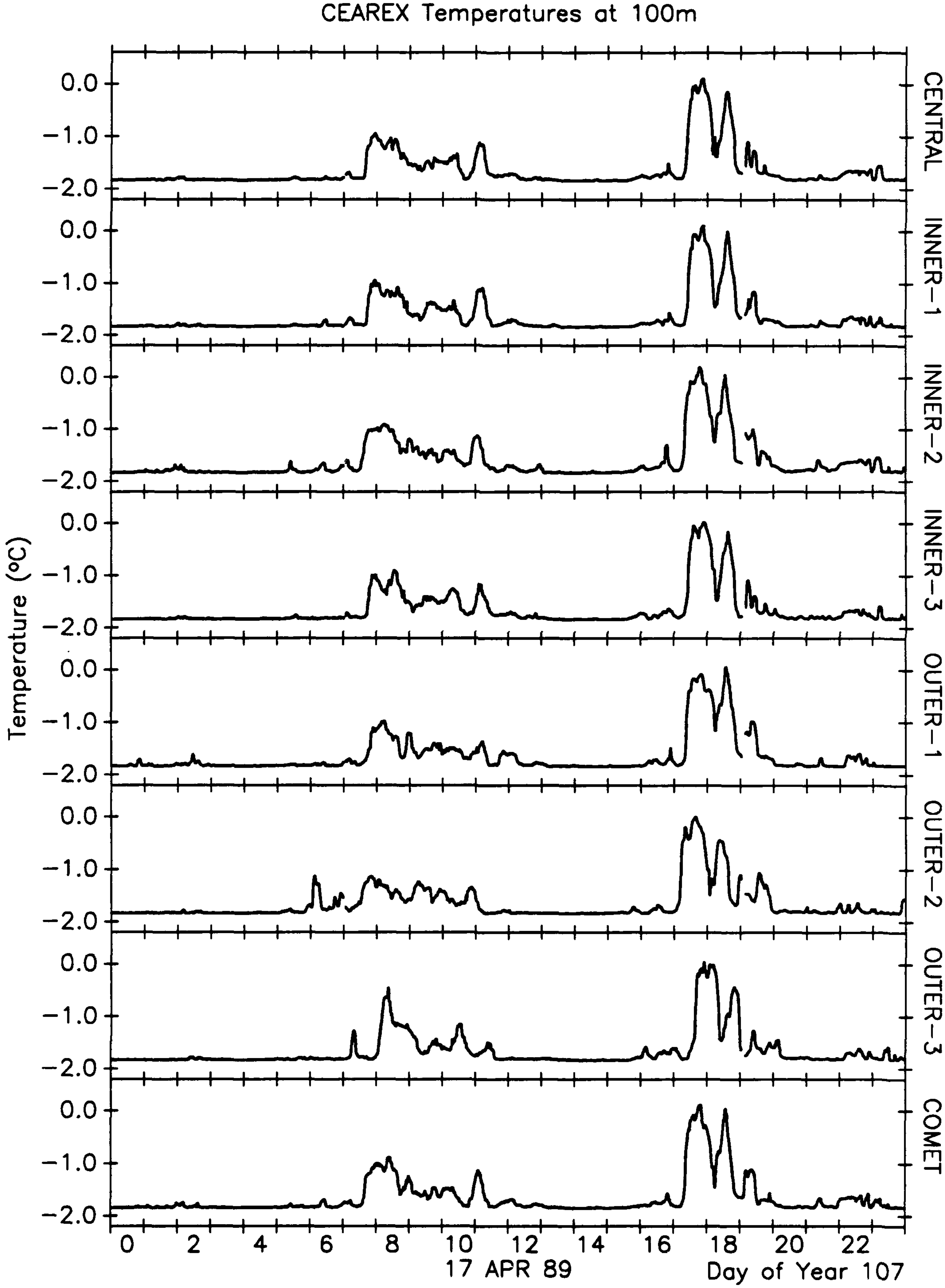

CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
12 APR 89
Day of Year 102

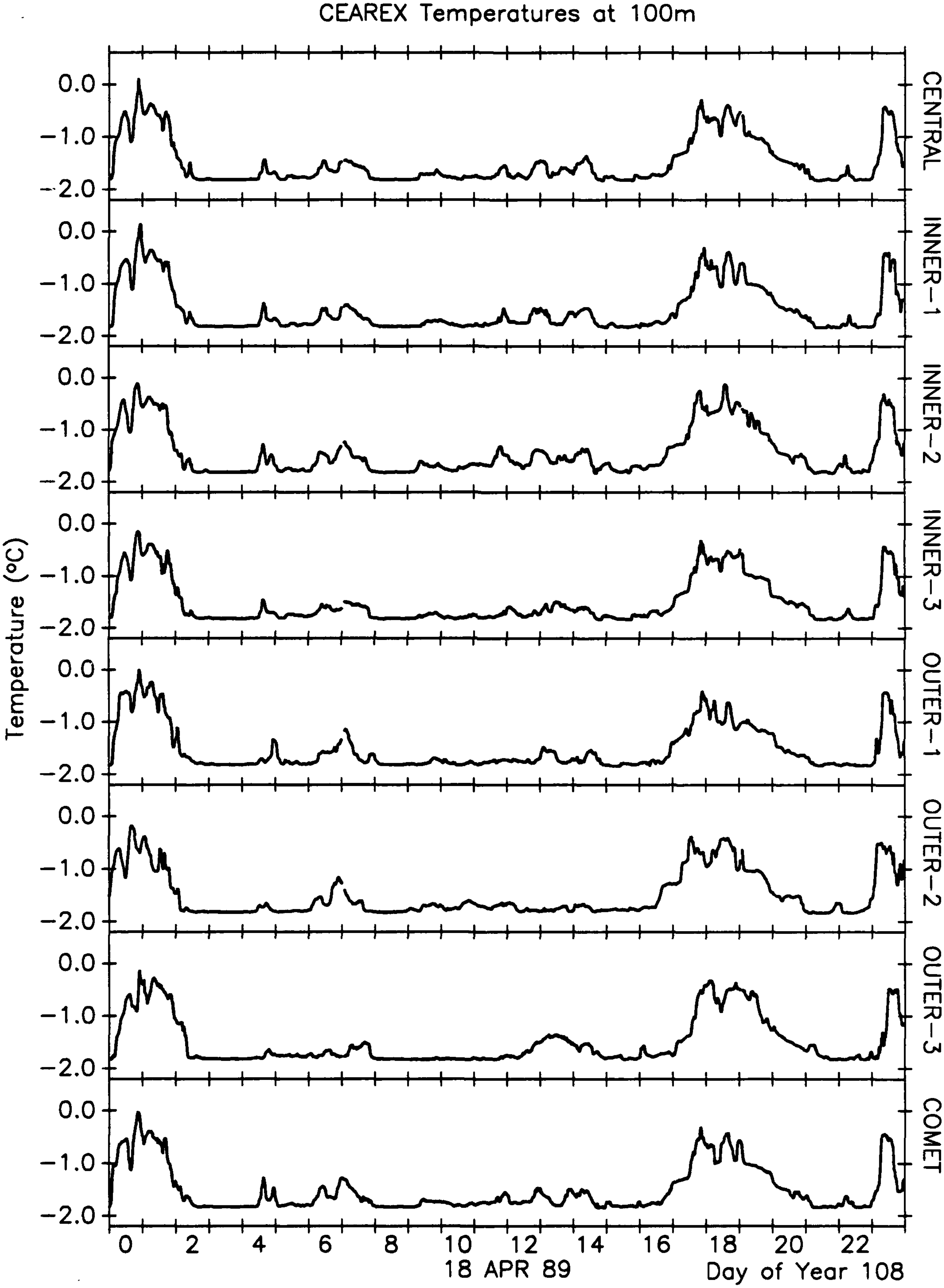

CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
13 APR 89
Day of Year 103

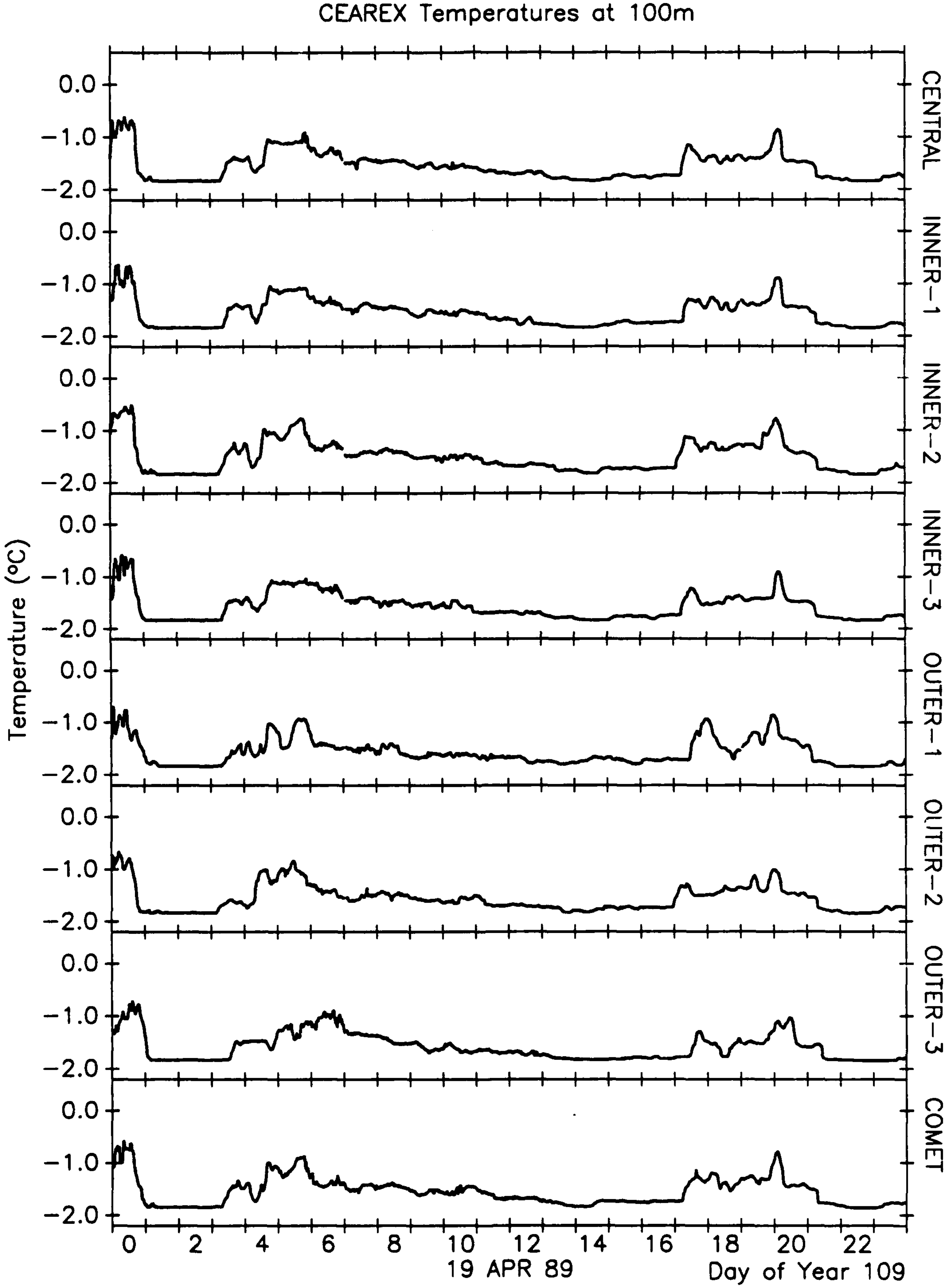

CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
14 APR 89
Day of Year 104

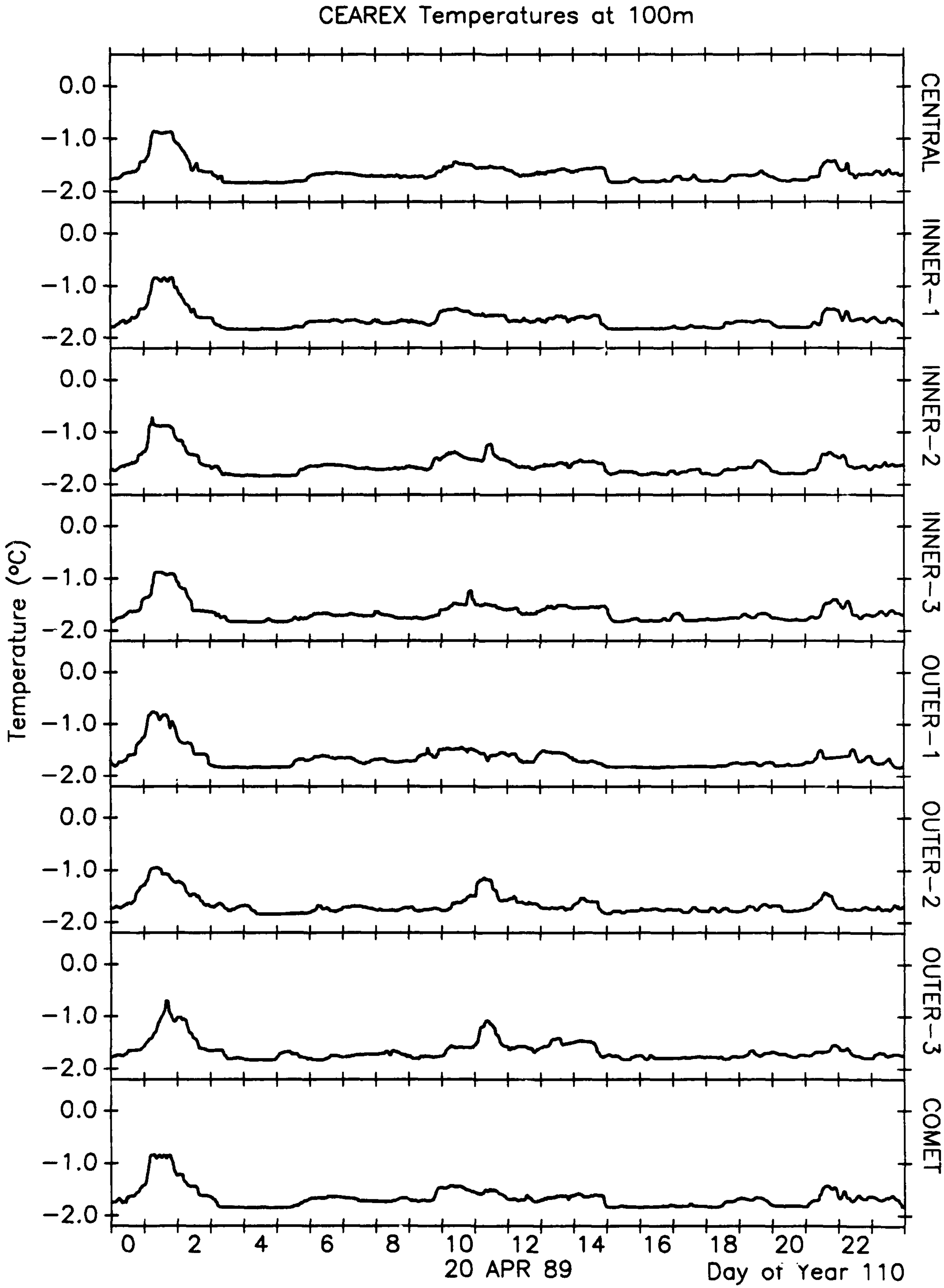

CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
15 APR 89
Day of Year 105


CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
16 APR 89
Day of Year 106


CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
17 APR 89
Day of Year 107

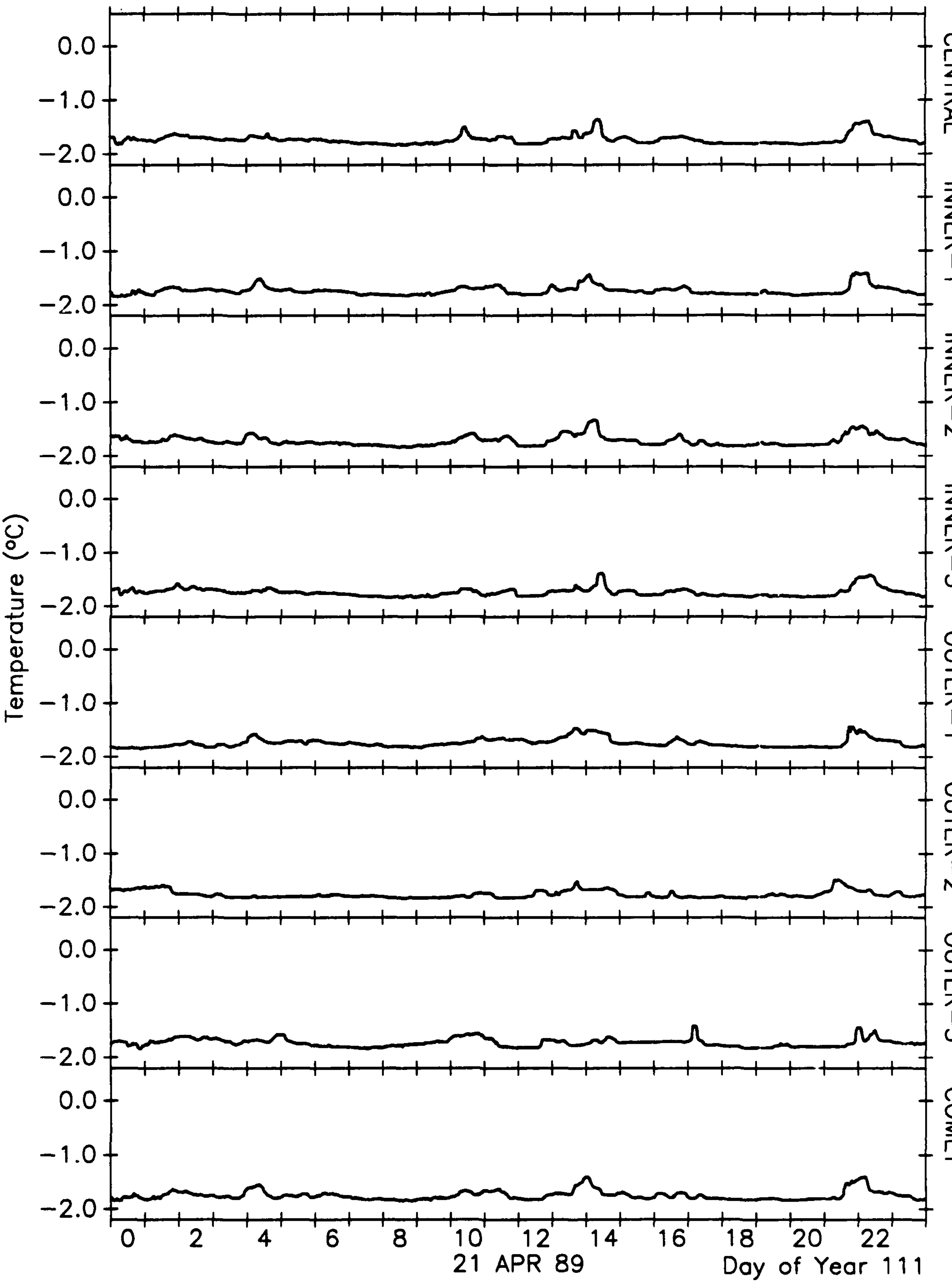

CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
18 APR 89
Day of Year 108

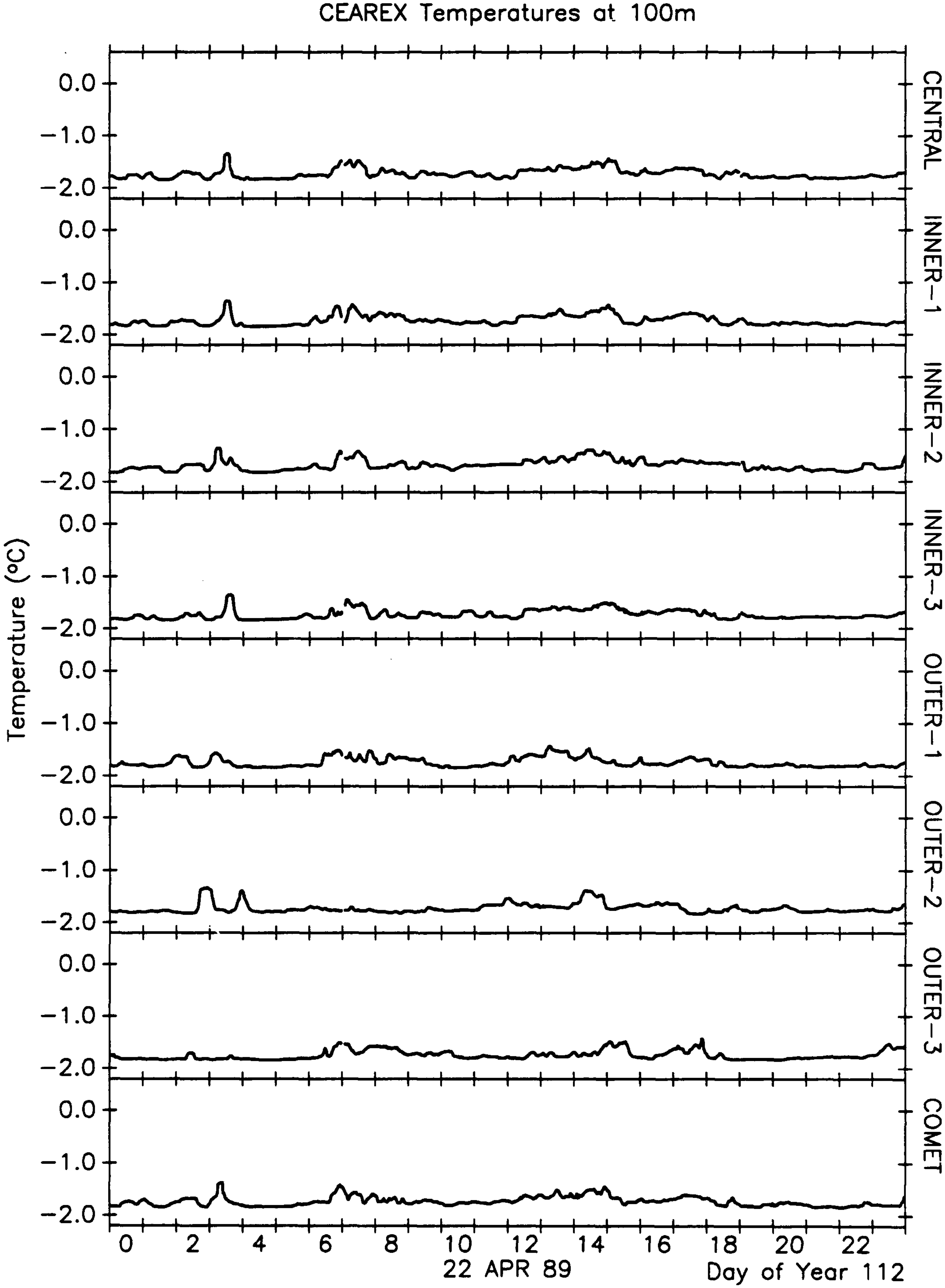

CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
19 APR 89
Day of Year 109

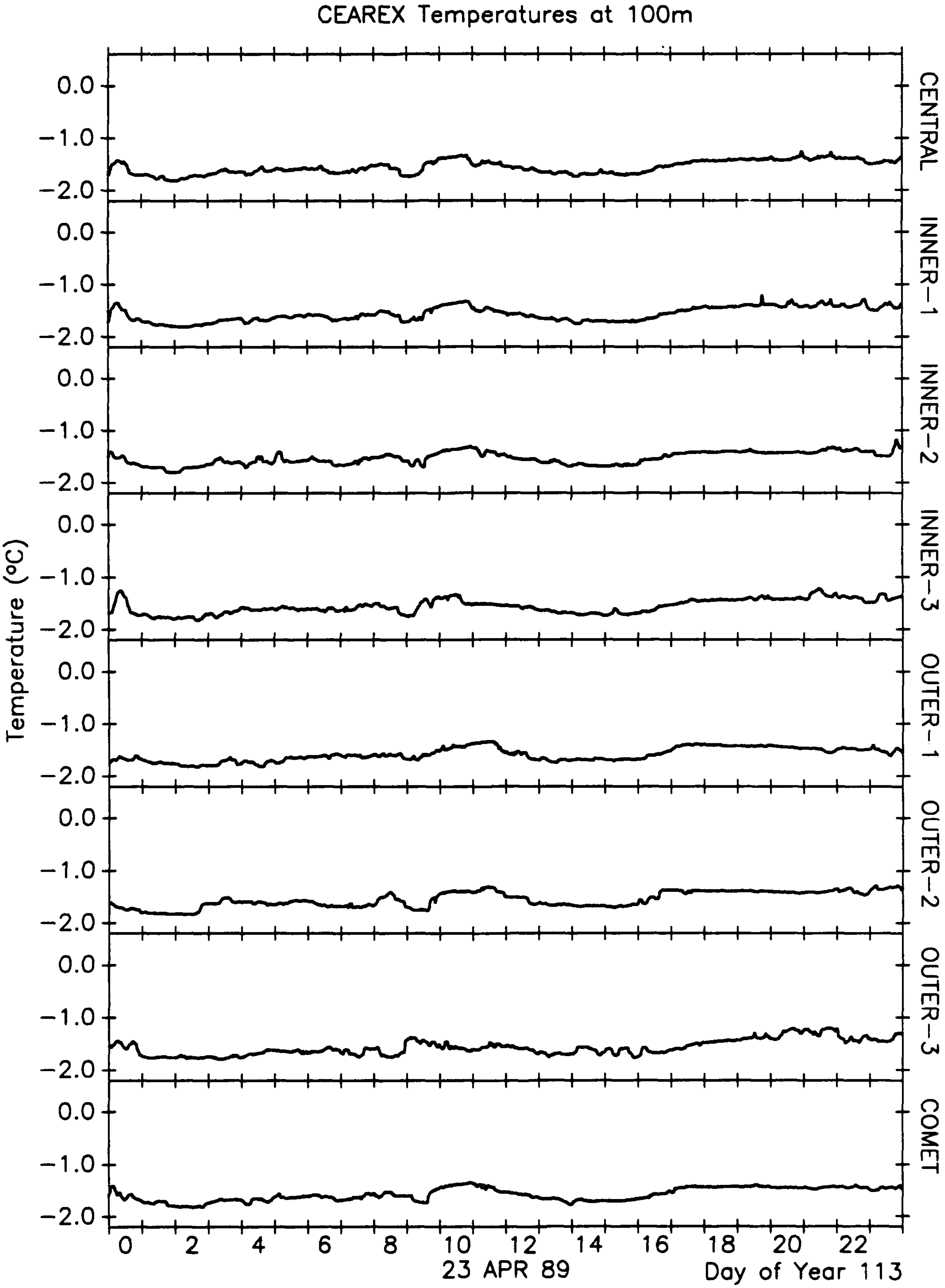


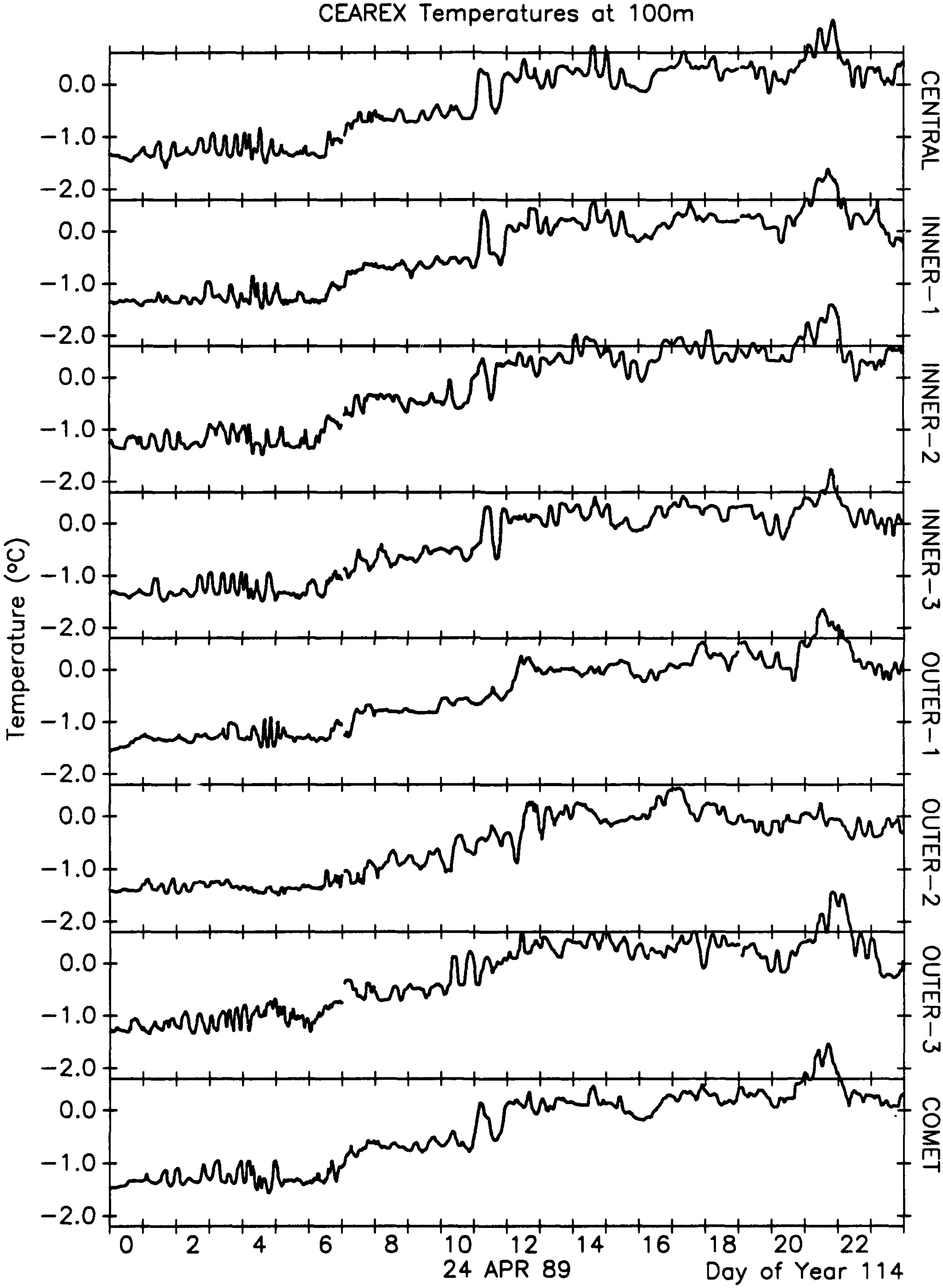
CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
20 APR 89
Day of Year 110

CEAREX Temperatures at 100m

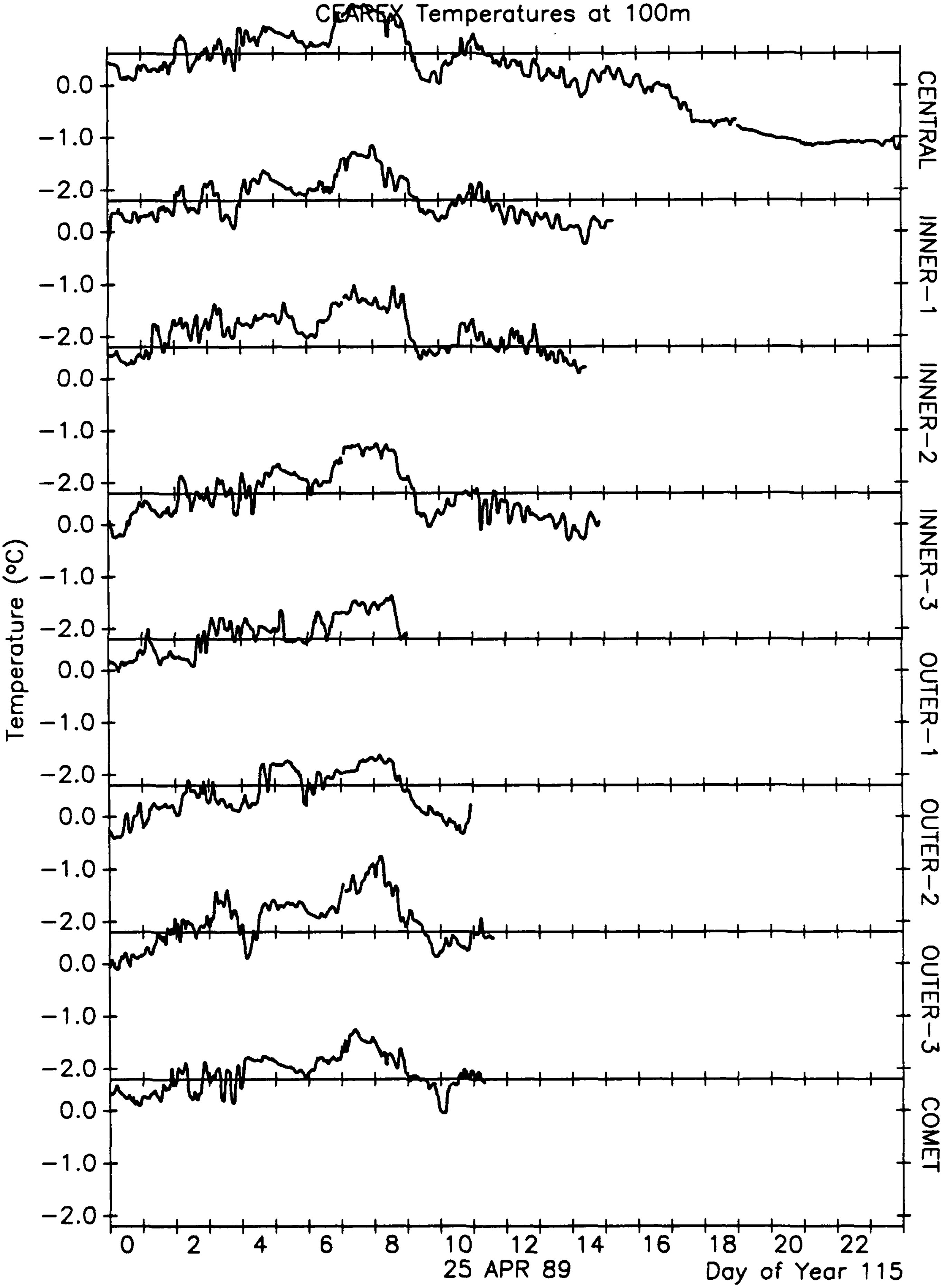


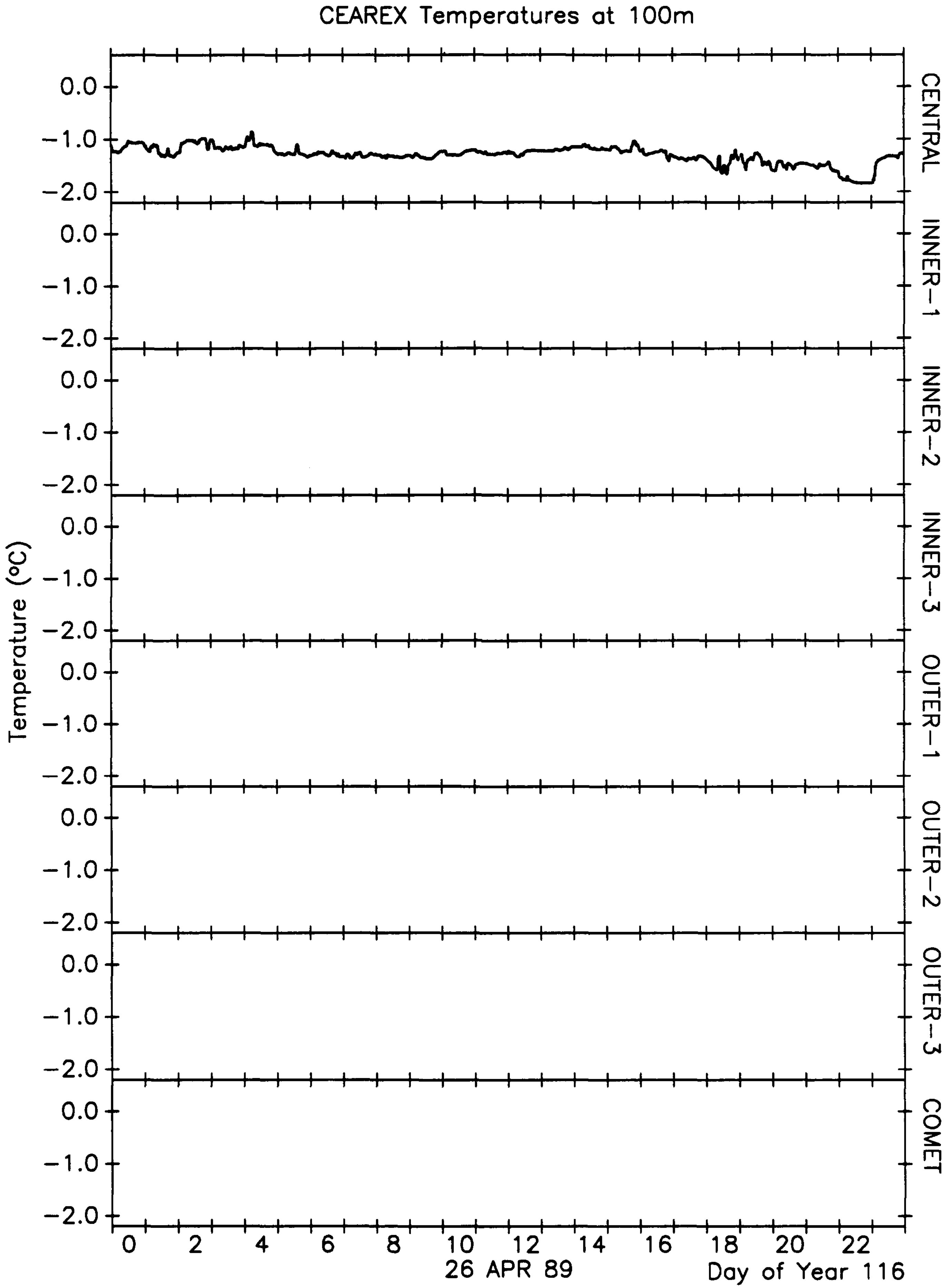

CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0 2 4 6 8 10 12 14 16 18 20 22
22 APR 89
Day of Year 112


CEAREX Temperatures at 100m
Temperature (°C)
0.0
-1.0
-2.0
CENTRAL
INNER-1
INNER-2
INNER-3
OUTER-1
OUTER-2
OUTER-3
COMET
0 2 4 6 8 10 12 14 16 18 20 22
23 APR 89
Day of Year 113

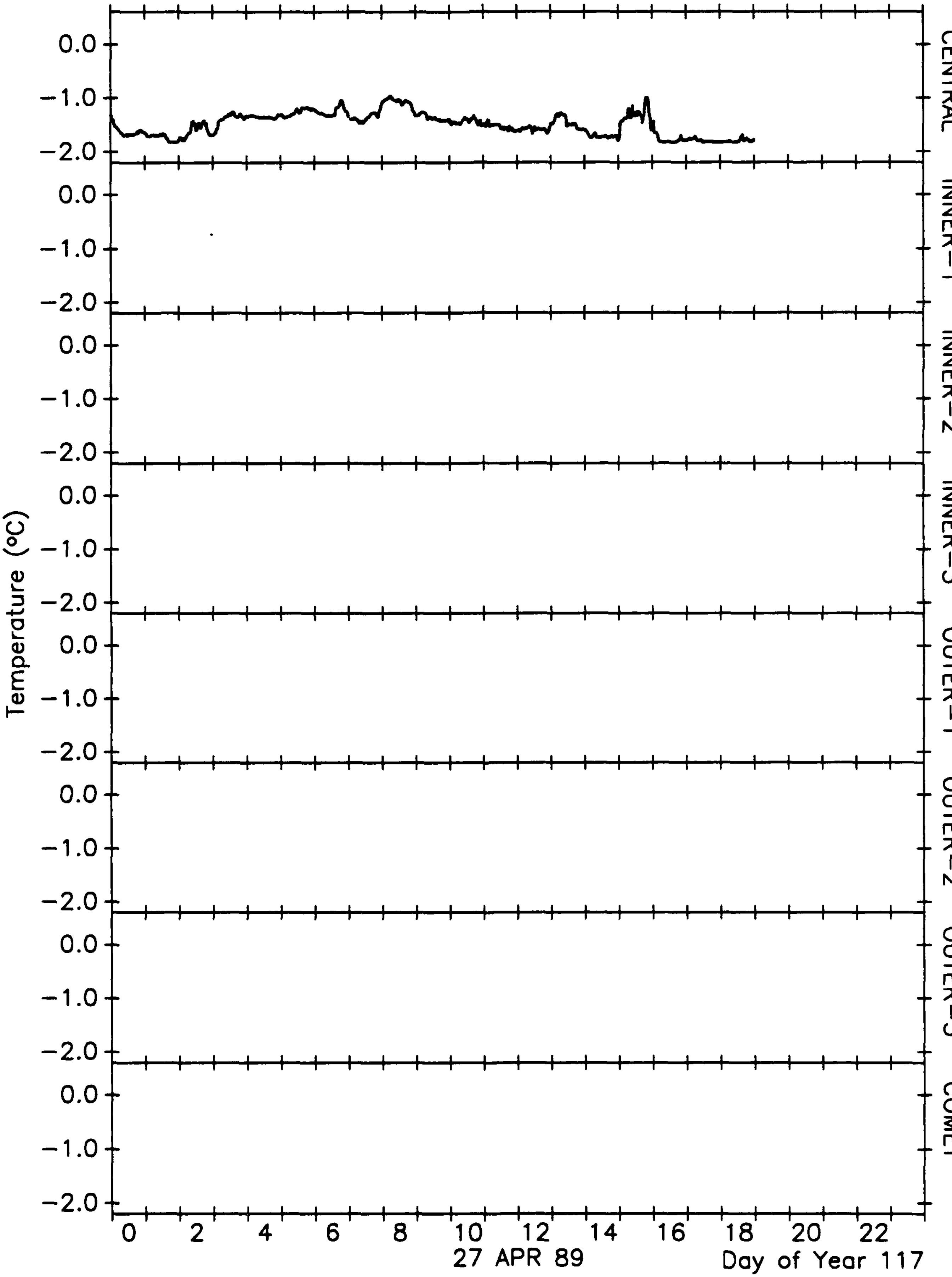


CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
24 APR 89
Day of Year 114


CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0 2 4 6 8 10 12 14 16 18 20 22
25 APR 89
Day of Year 115


CEAREX Temperatures at 100m
Temperature (°C)
0.0
−1.0
−2.0
CENTRAL
INNER−1
INNER−2
INNER−3
OUTER−1
OUTER−2
OUTER−3
COMET
0
2
4
6
8
10
12
14
16
18
20
22
26 APR 89
Day of Year 116

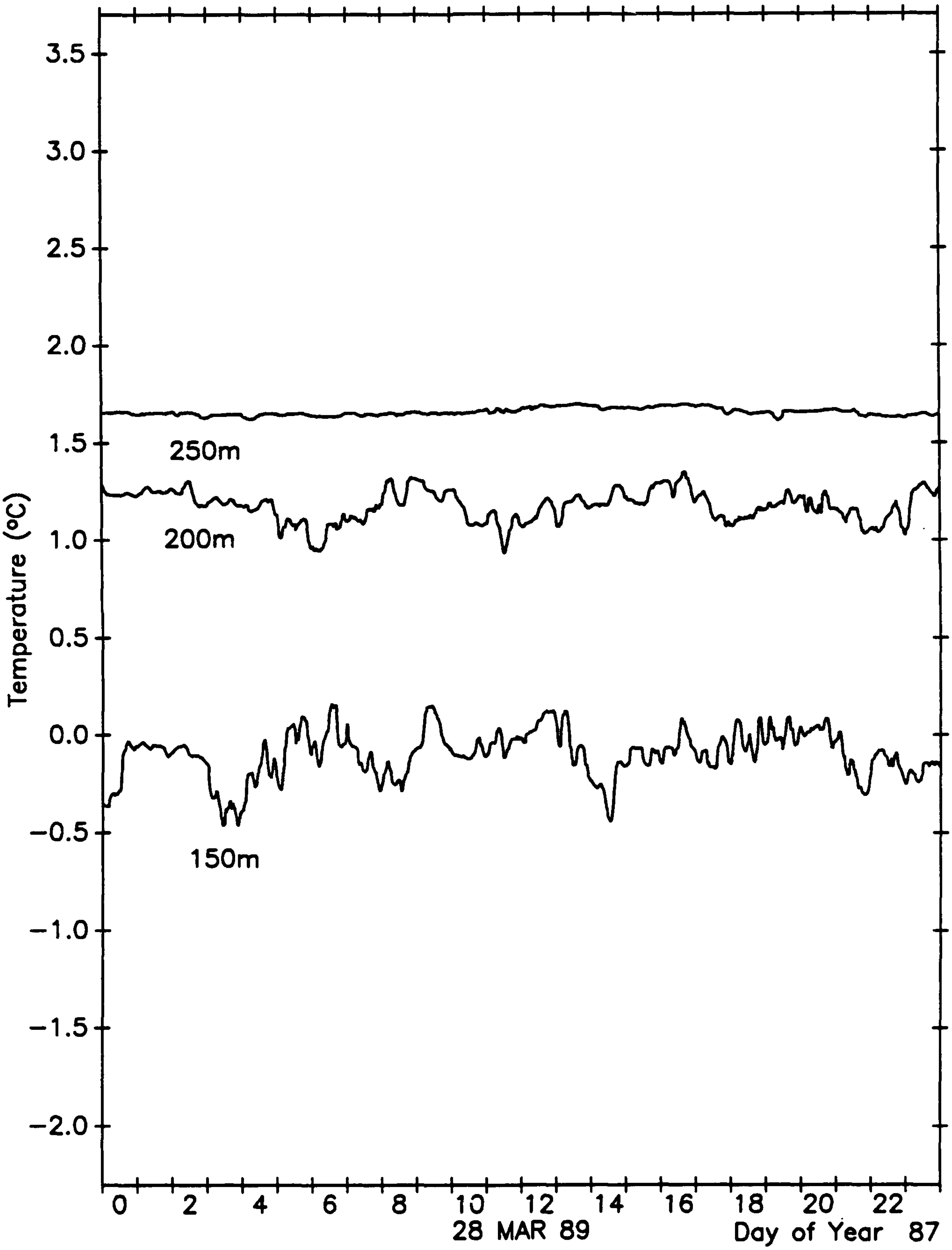
CEAREX Temperatures at 100m

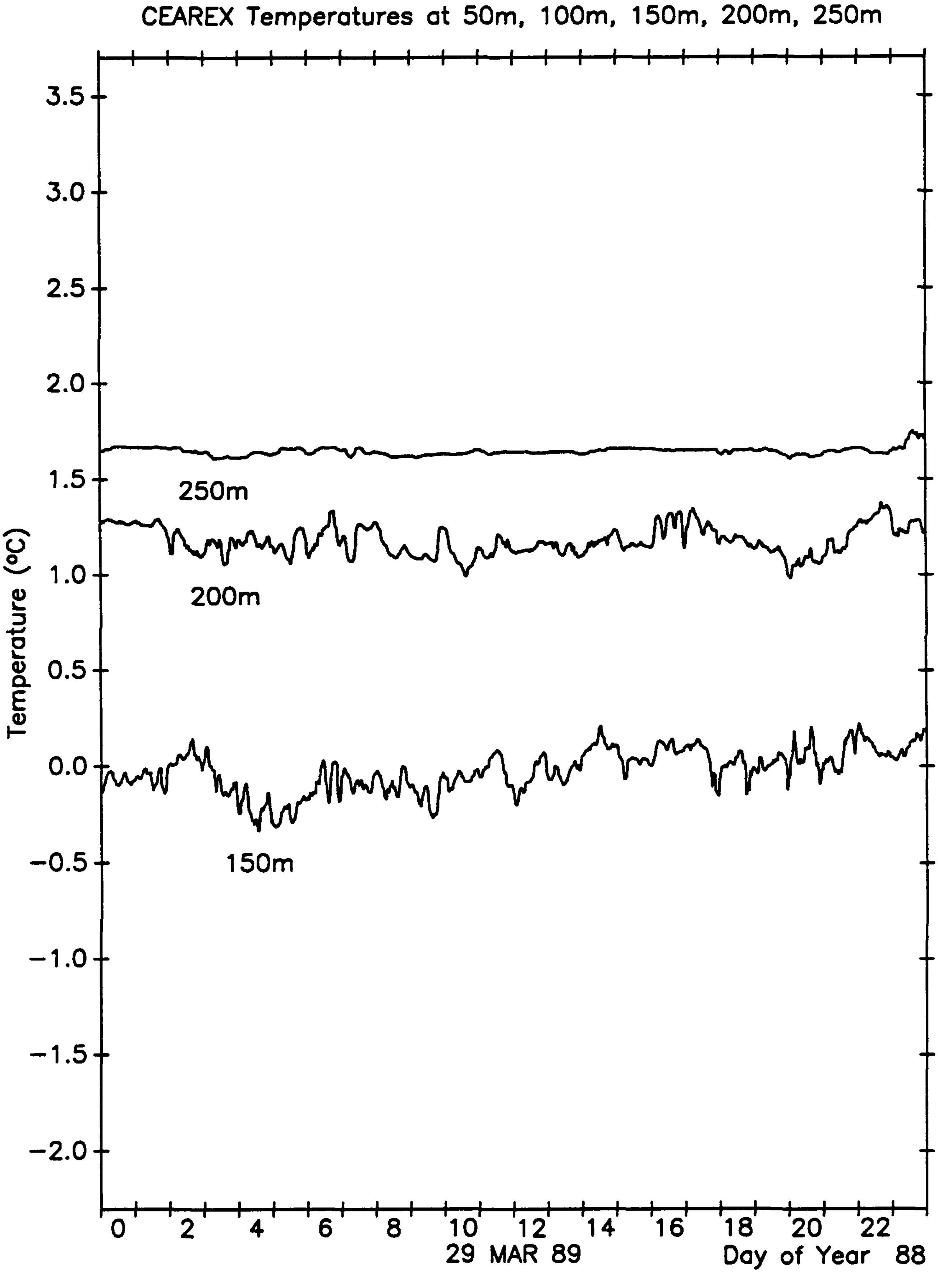


TIME SERIES OF TEMPERATURE AT CENTRAL SITE: UNFILTERED

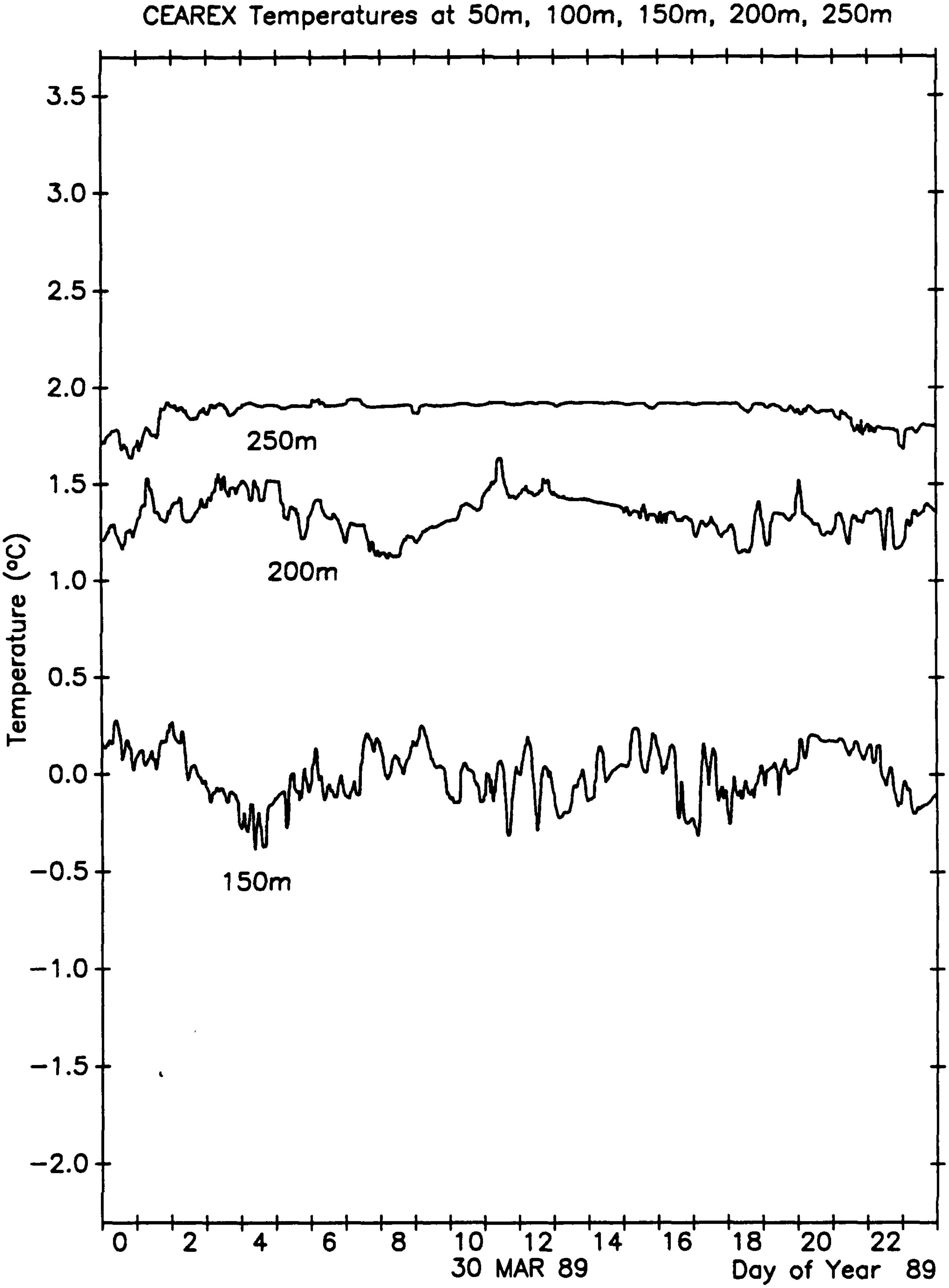
On the following 31 pages are observations of temperature from the Central site at depths of 50, 100, 150, 200 and 250 m.

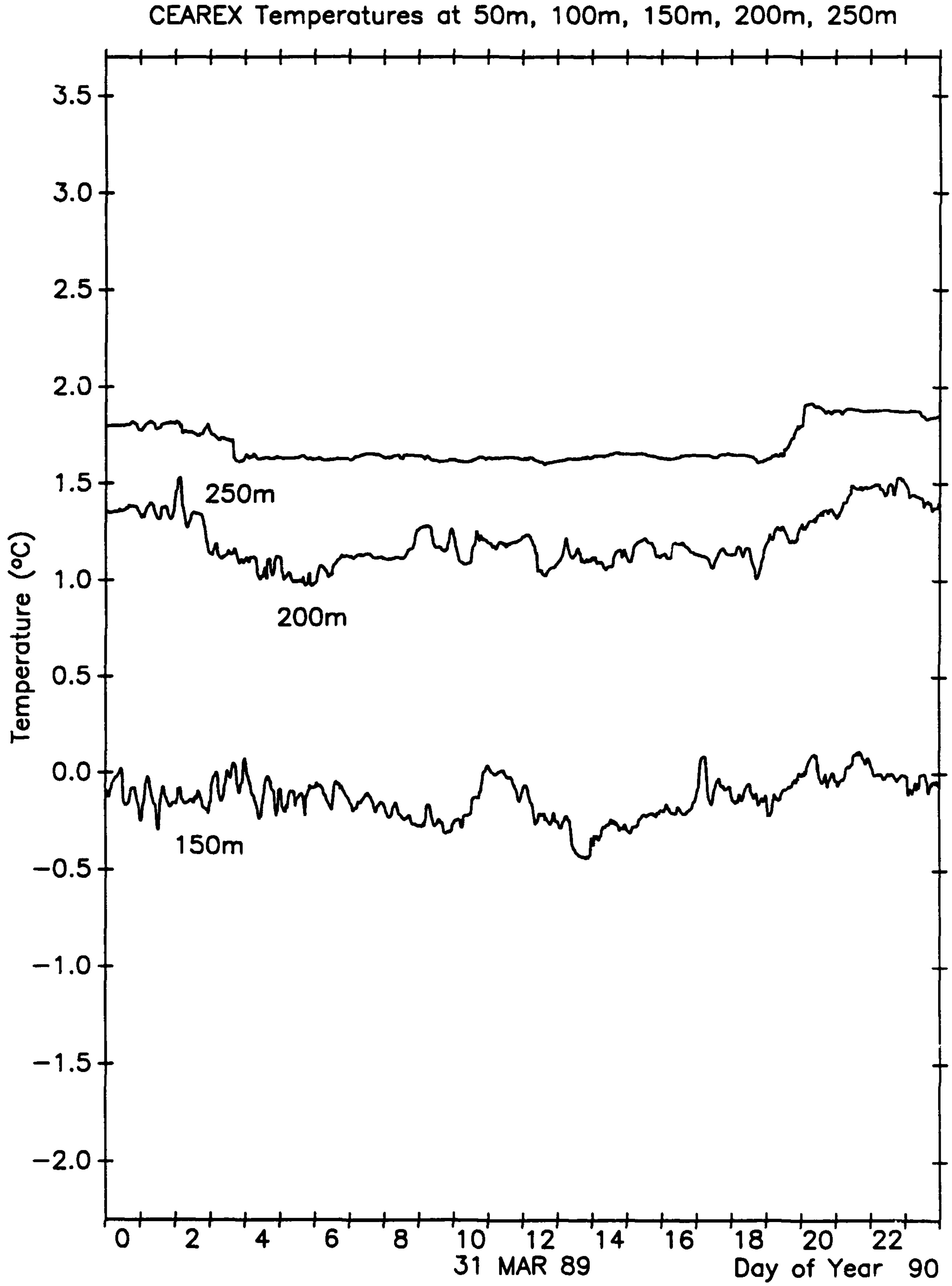
CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m

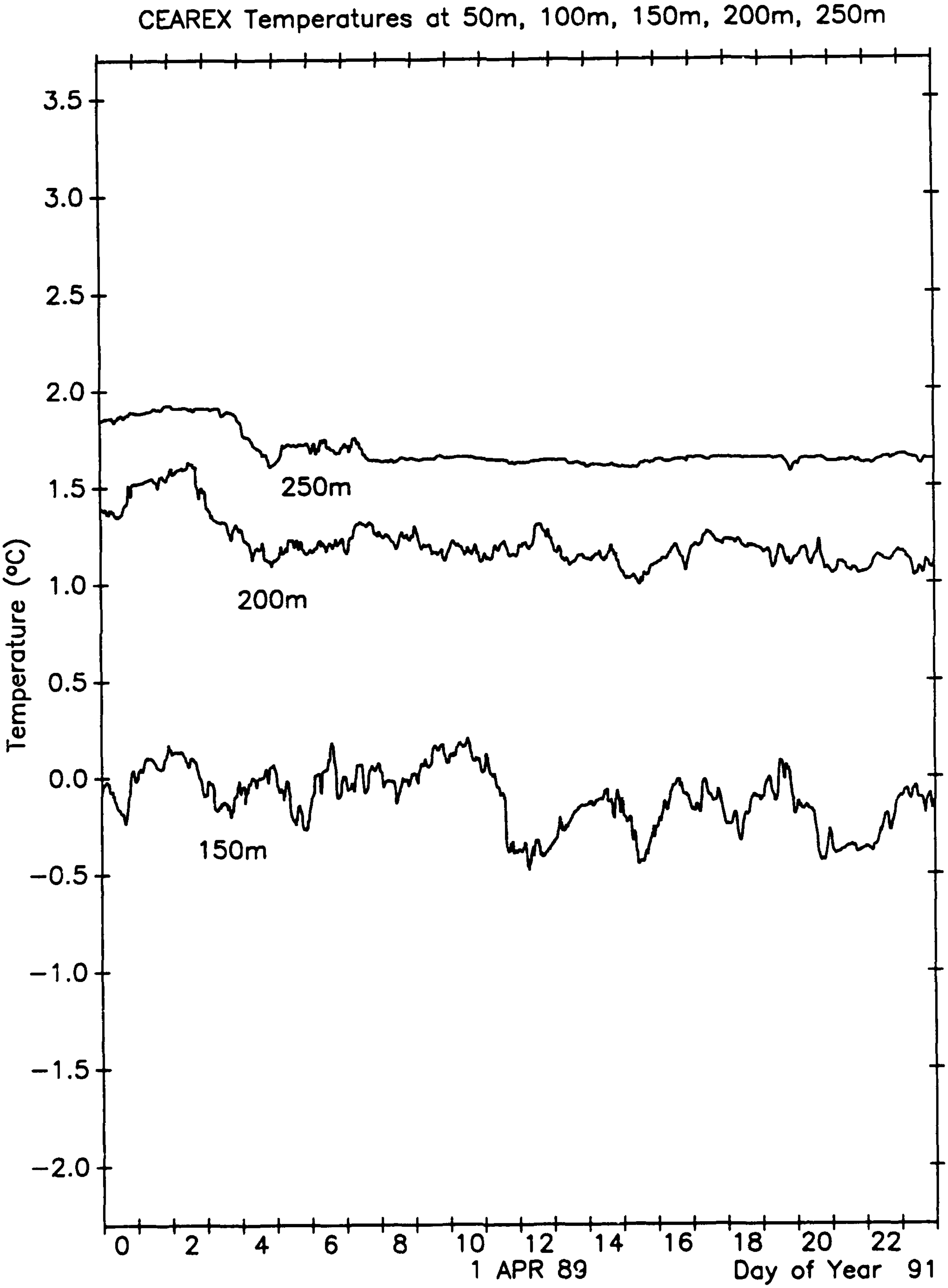




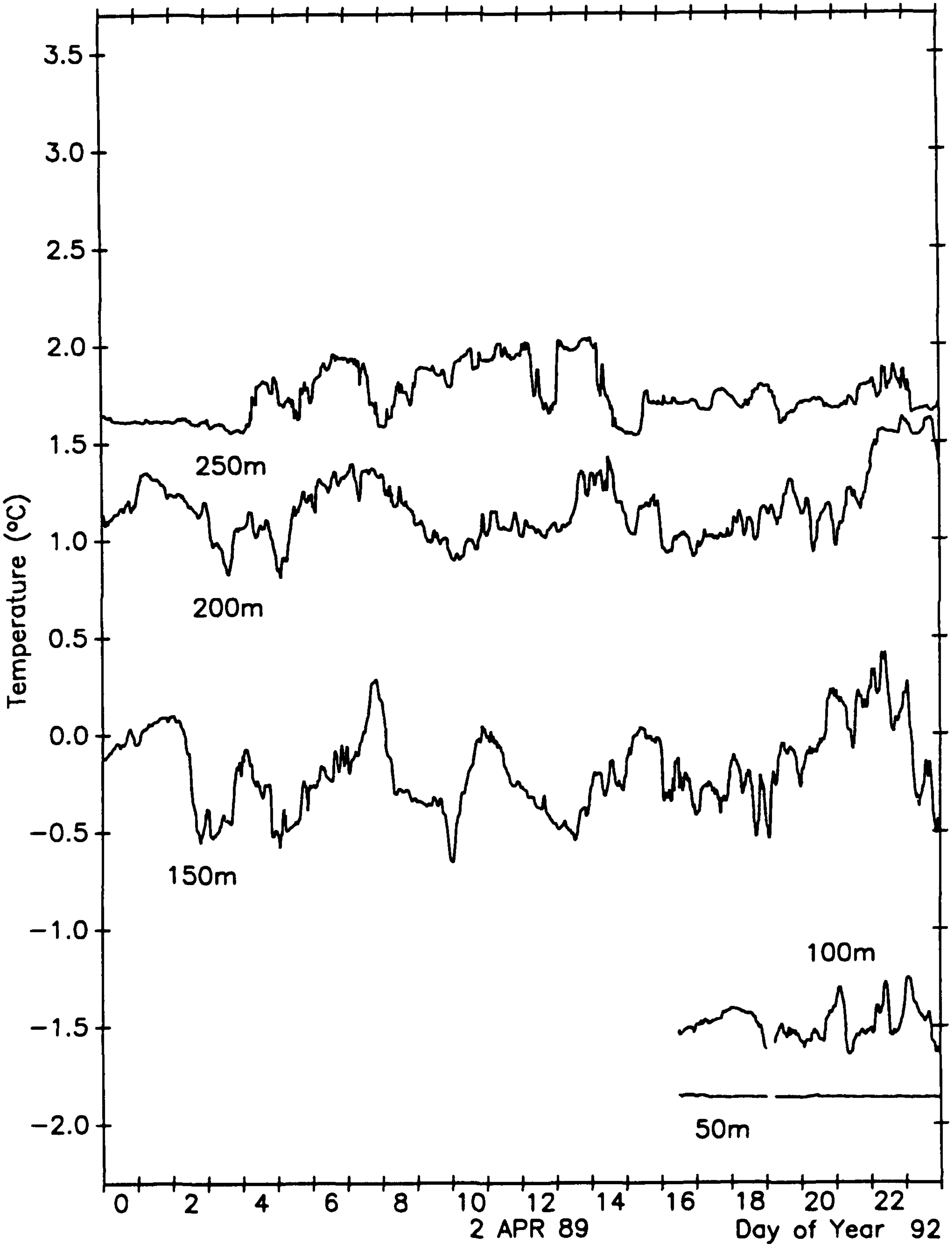
CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
Temperature (ºC)
250m
200m
150m
0
2
4
6
8
10
12
14
16
18
20
22
29 MAR 89
Day of Year 88


CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
250m
200m
150m
0
2
4
6
8
10
12
14
16
18
20
22
30 MAR 89
Day of Year 89

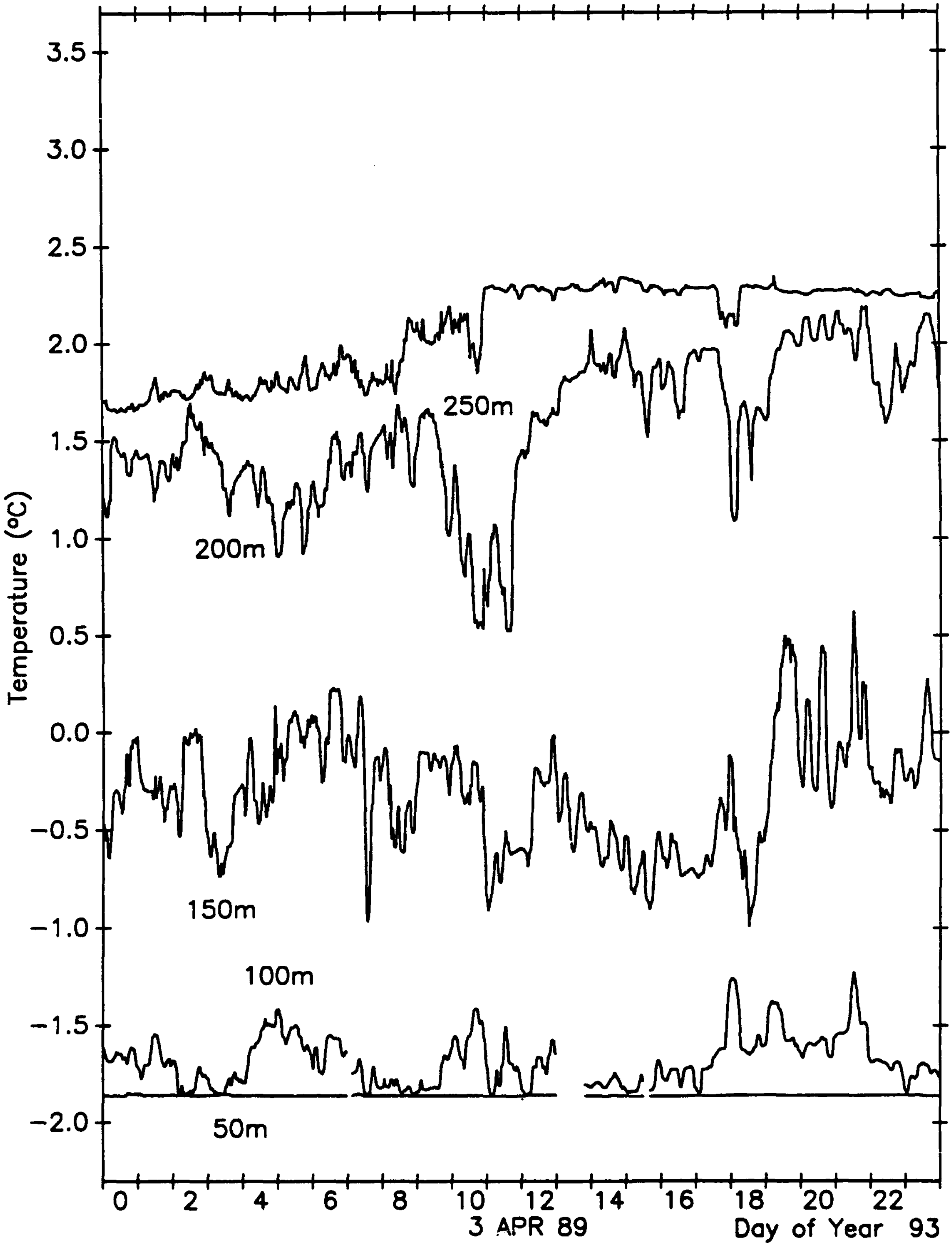

CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
250m
200m
150m
0
2
4
6
8
10
12
14
16
18
20
22
31 MAR 89
Day of Year 90

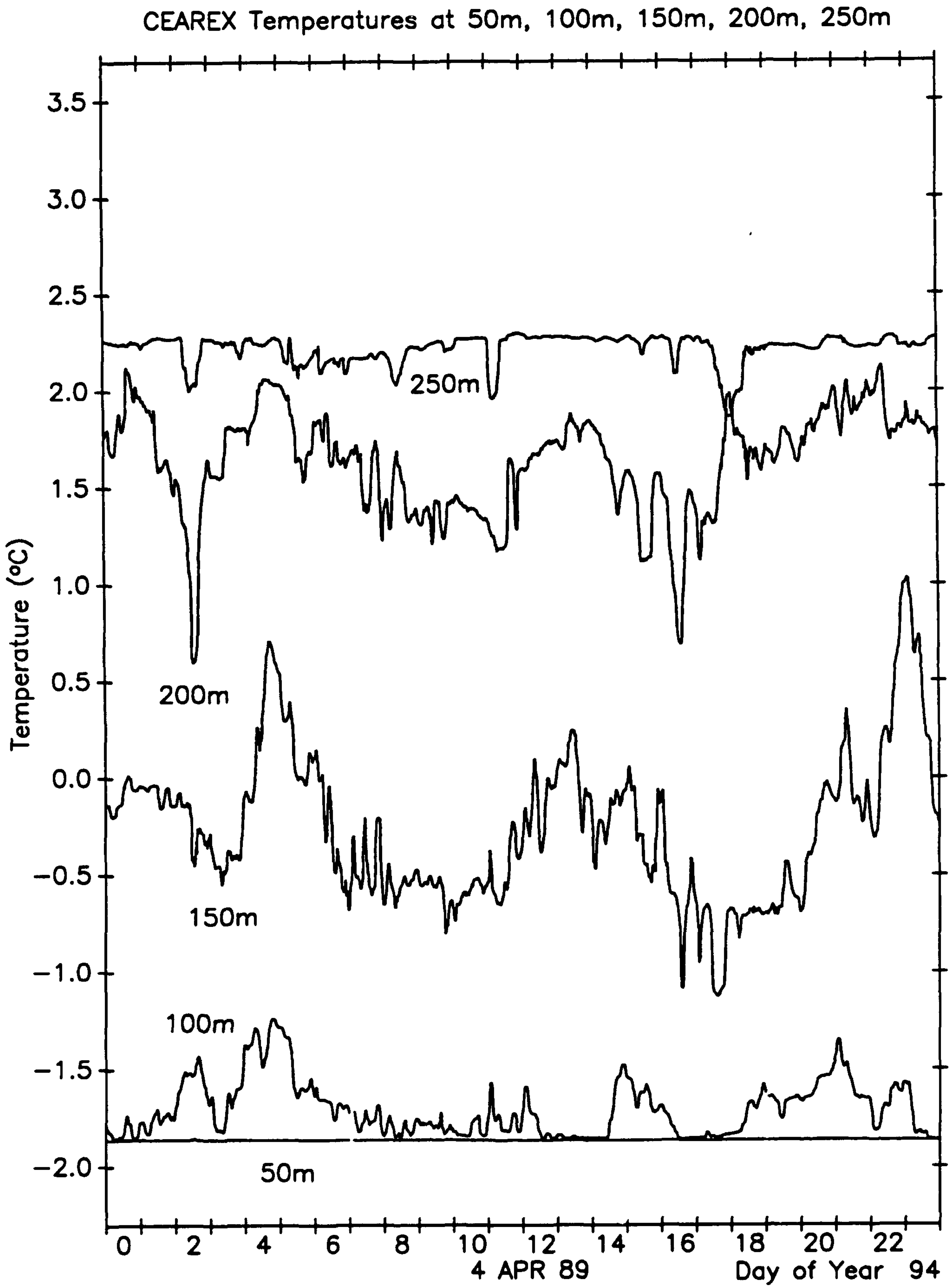

CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
250m
200m
150m
0
2
4
6
8
10
12
14
16
18
20
22
1 APR 89
Day of Year 91

CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m

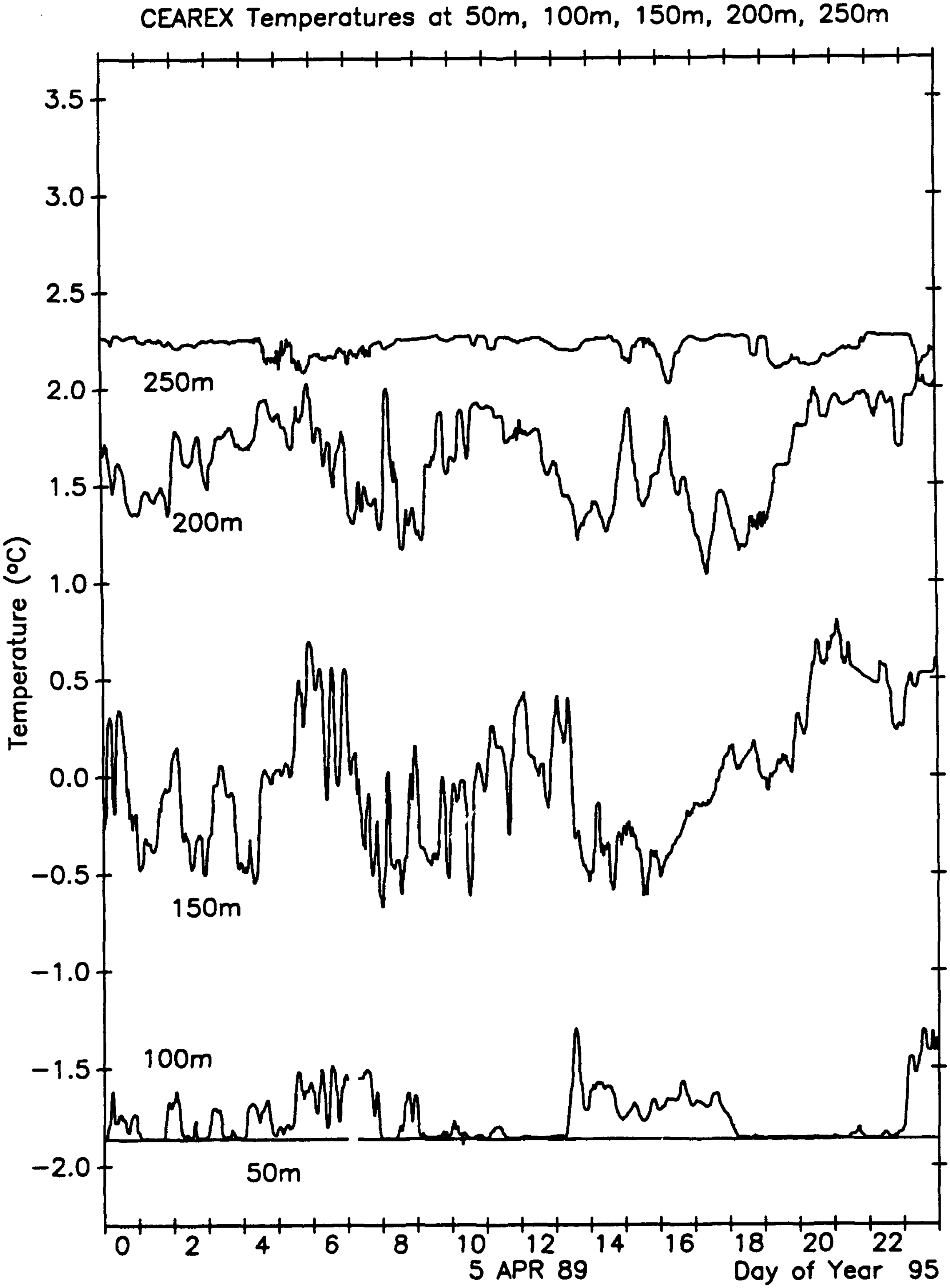


CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m

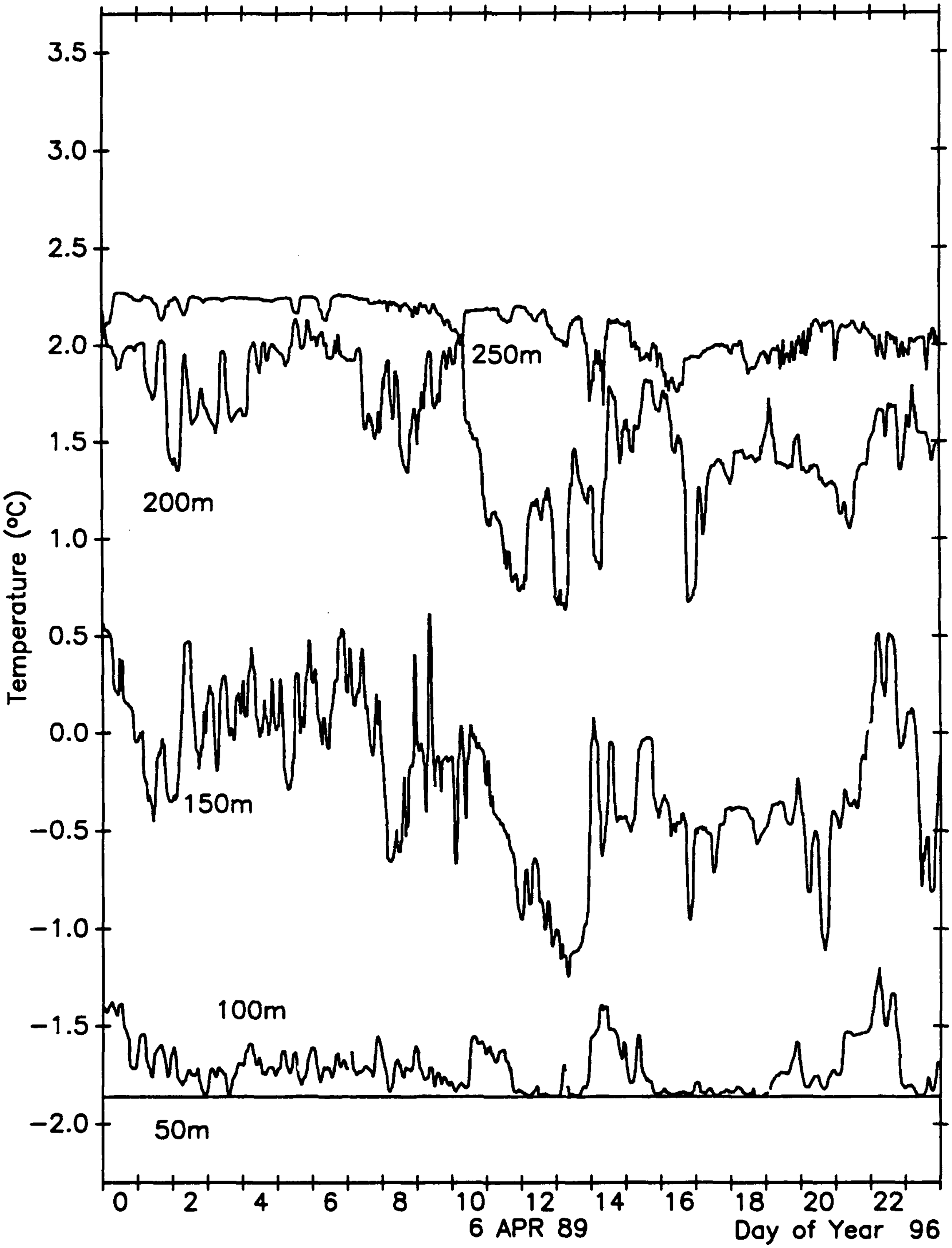


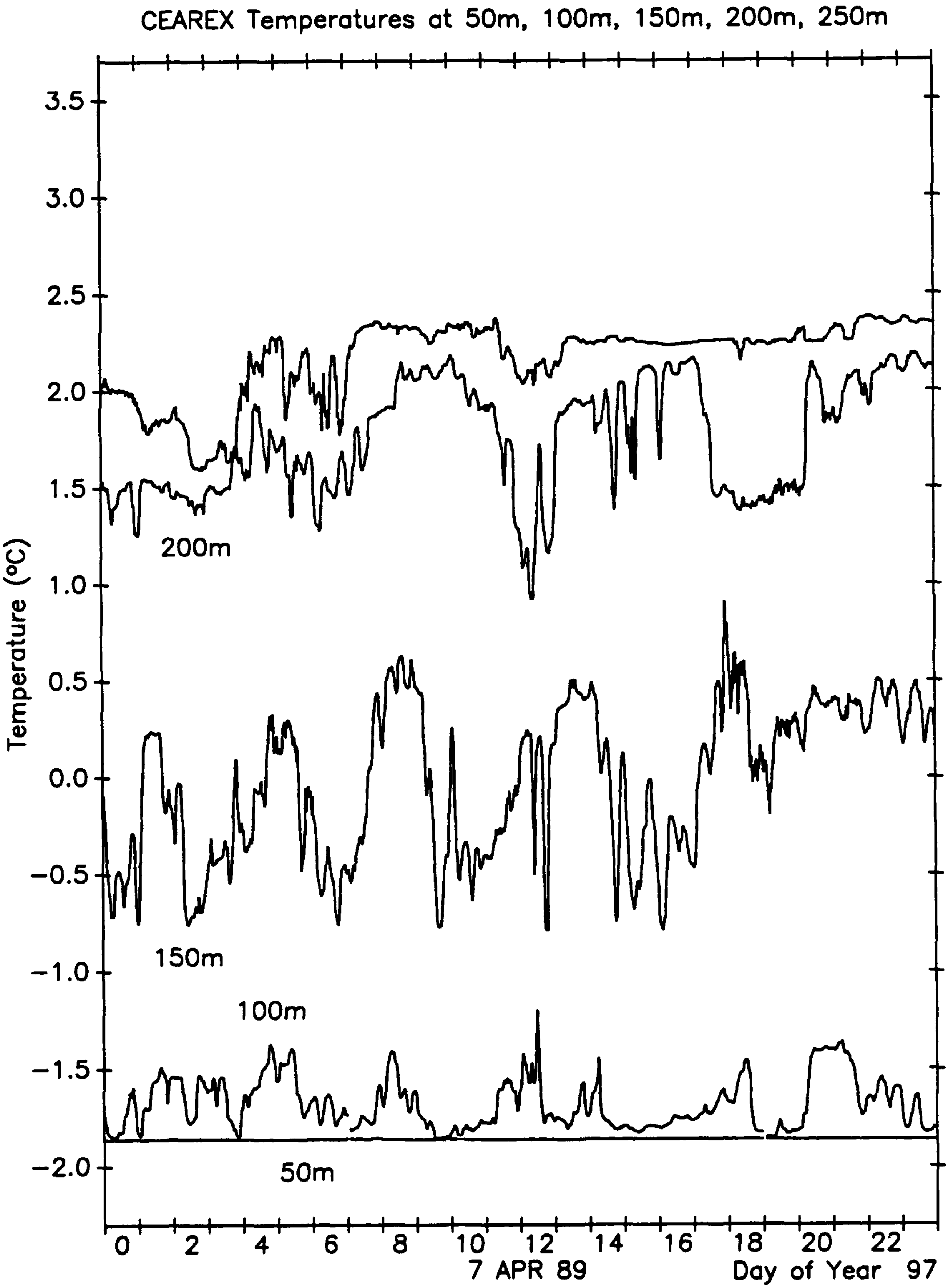


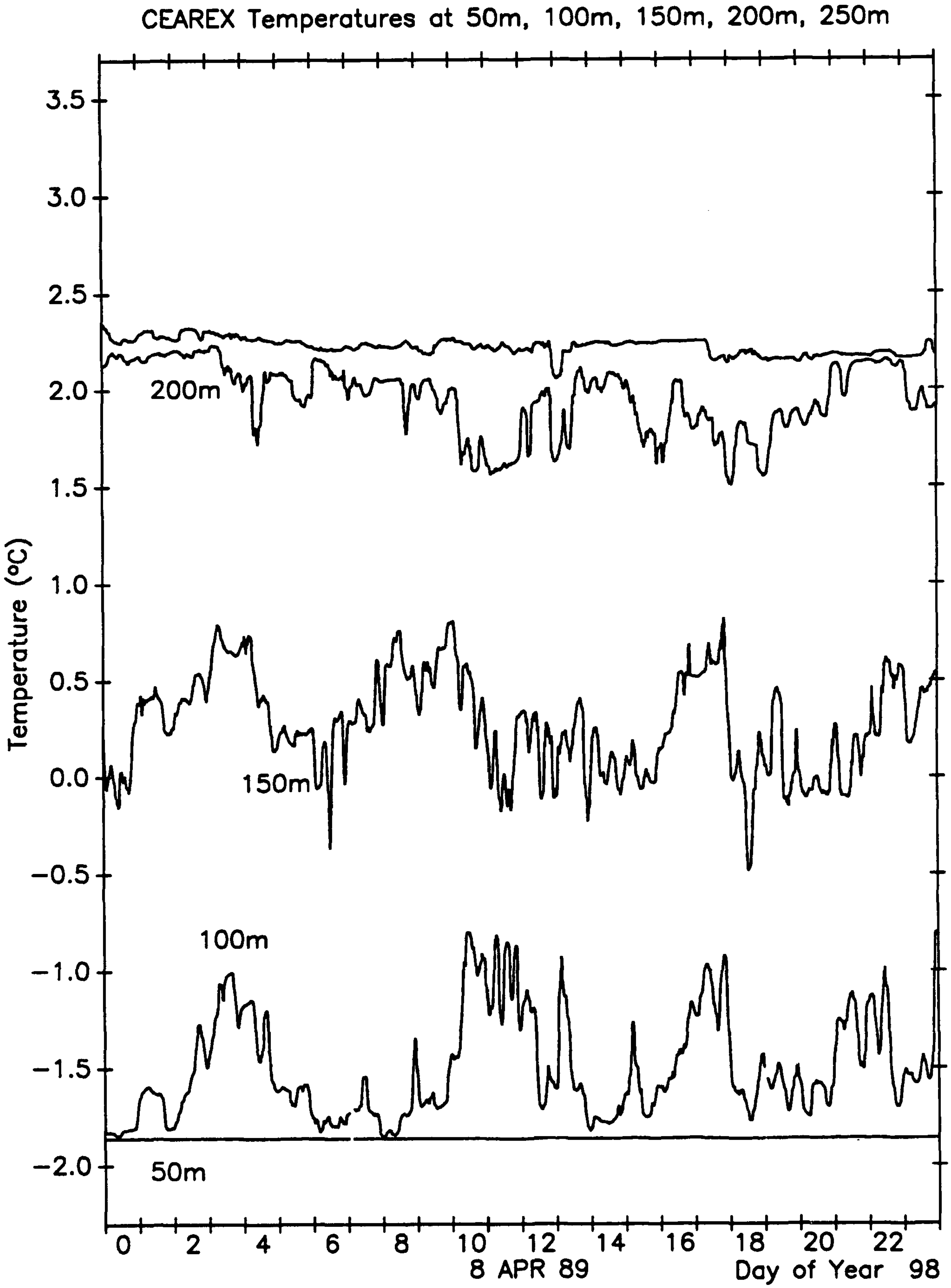
CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
250m
200m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
4 APR 89
Day of Year 94


CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
250m
200m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
5 APR 89
Day of Year 95

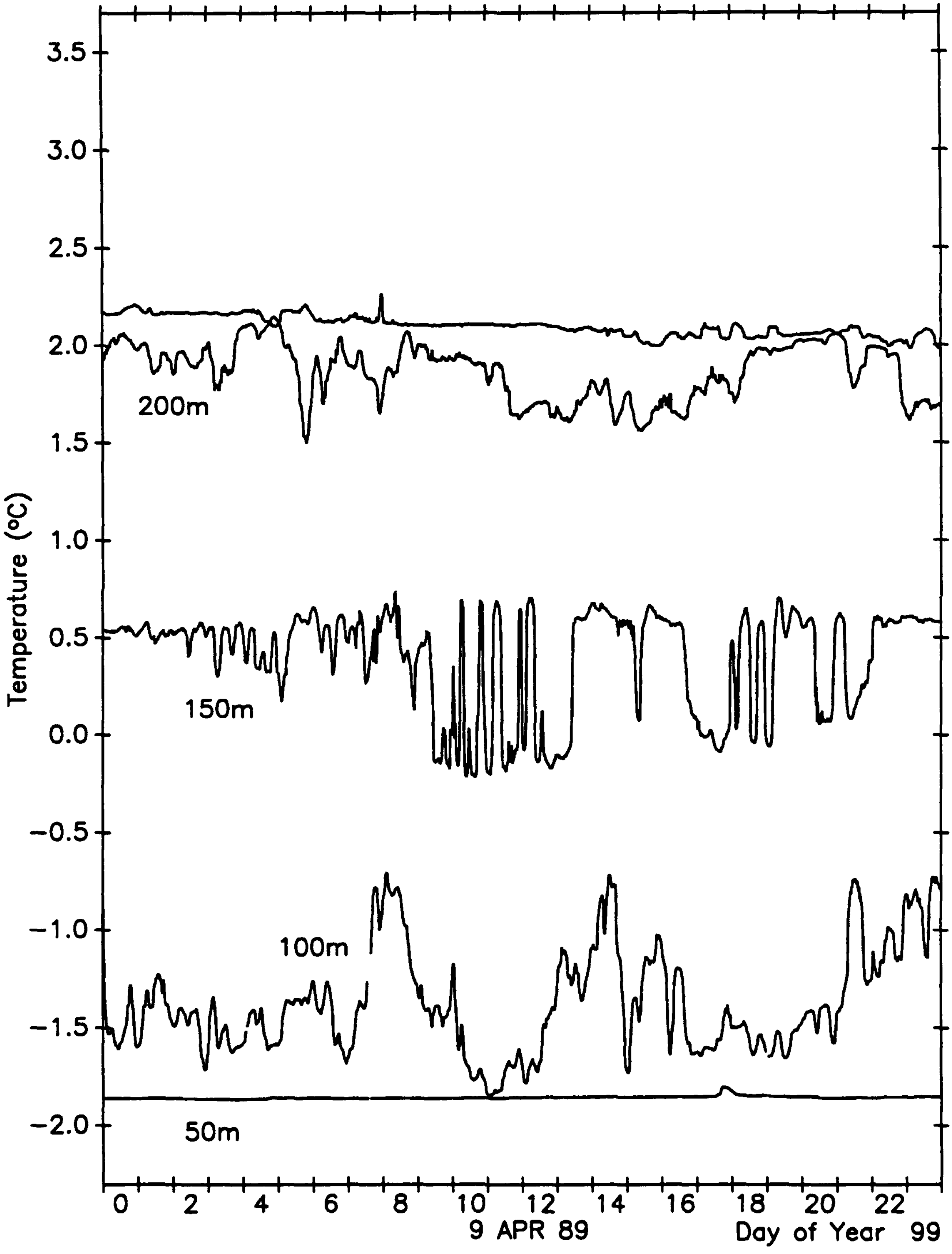
CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m

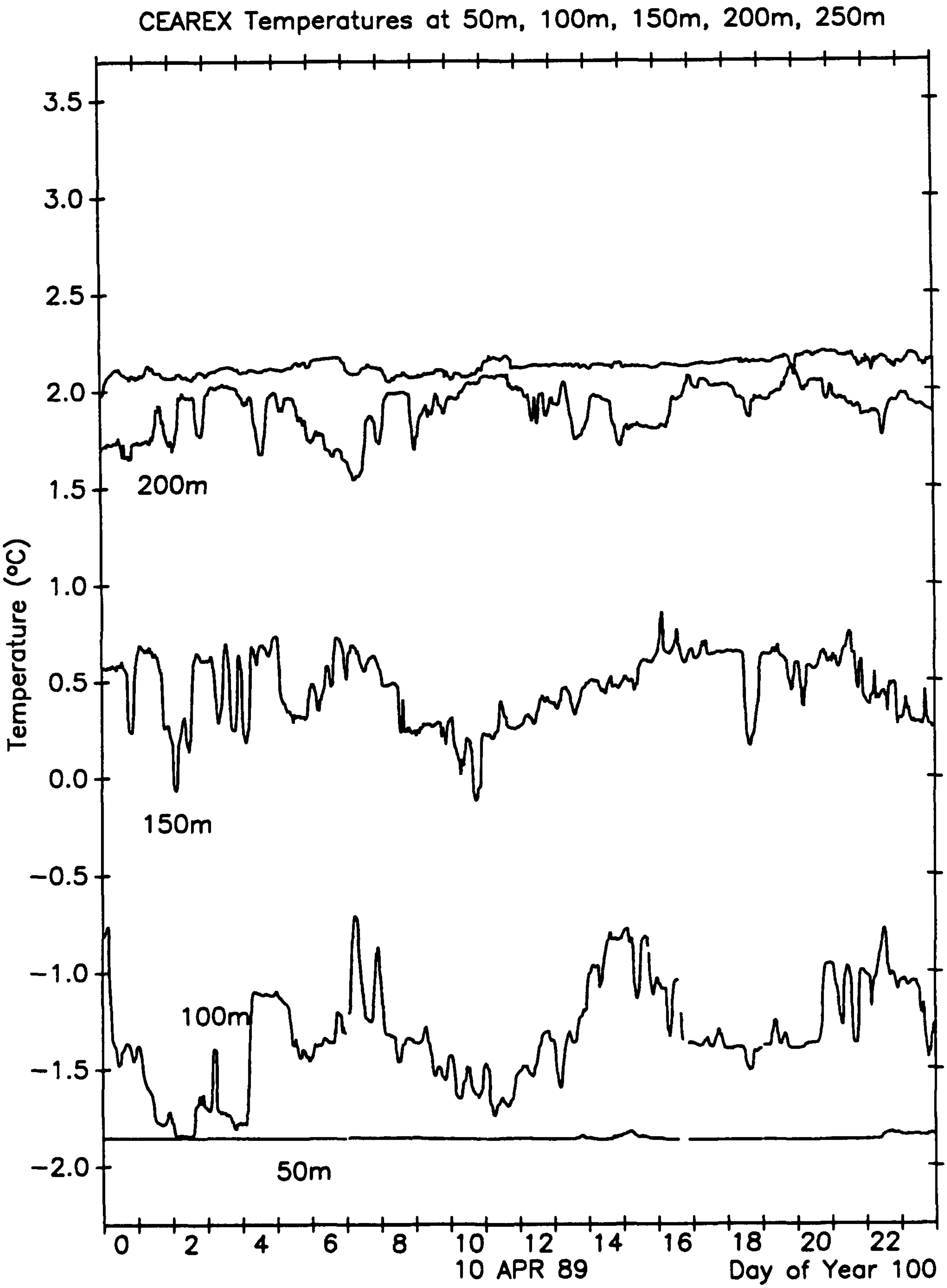


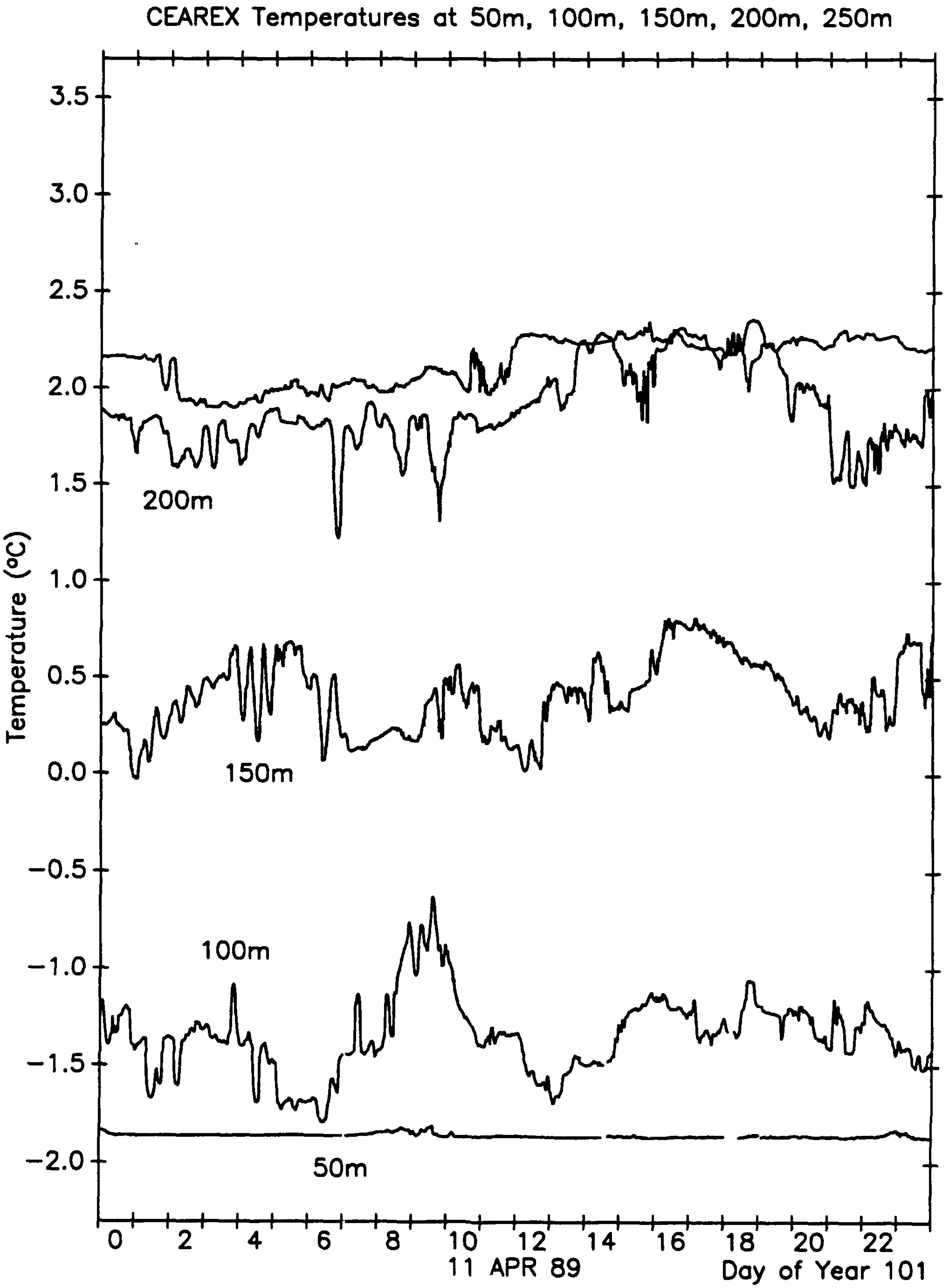

CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
200m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
7 APR 89
Day of Year 97

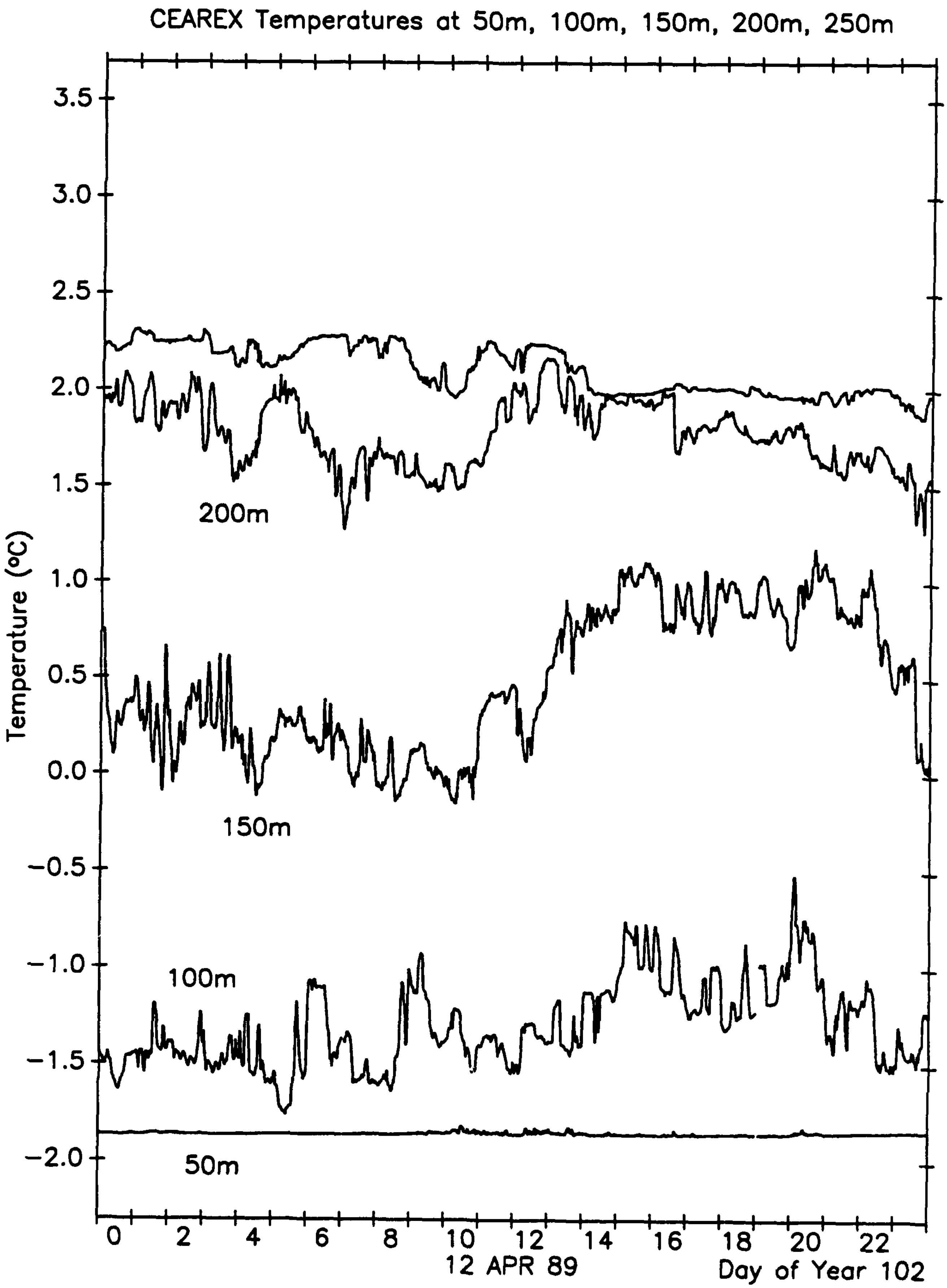

CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
200m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
8 APR 89
Day of Year 98

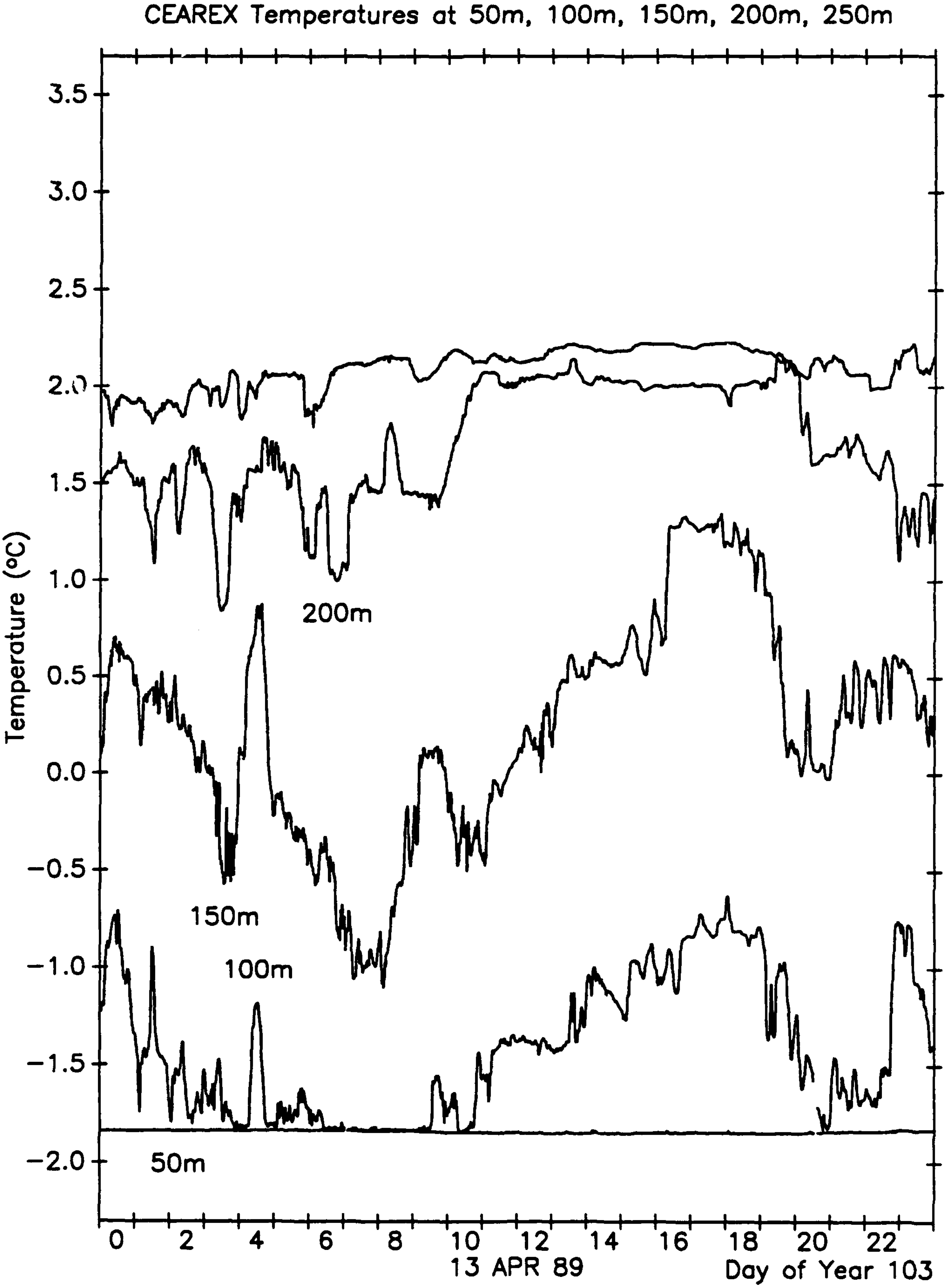
CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m



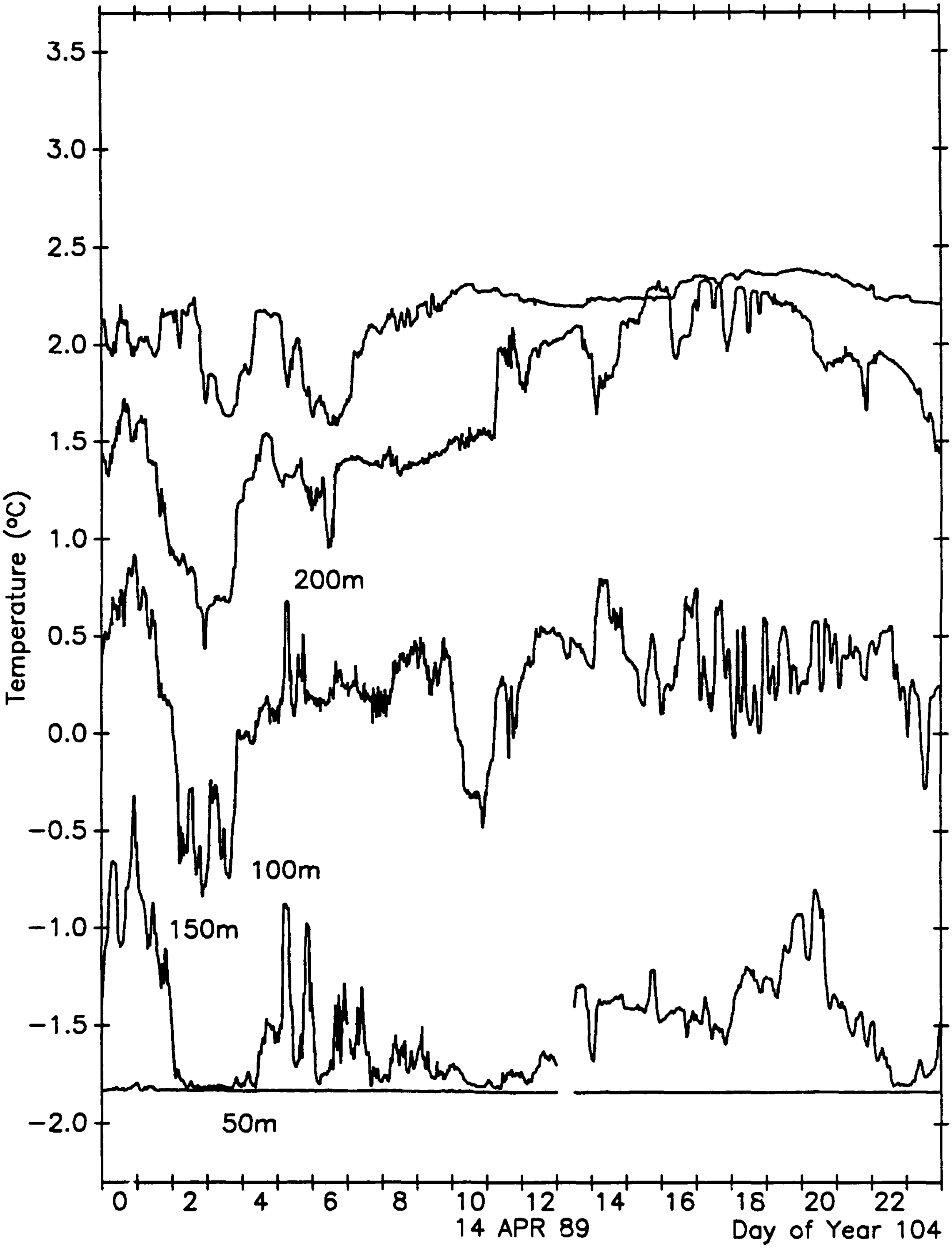

CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
200m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
10 APR 89
Day of Year 100


CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
Temperature (°C)
200m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
11 APR 89
Day of Year 101

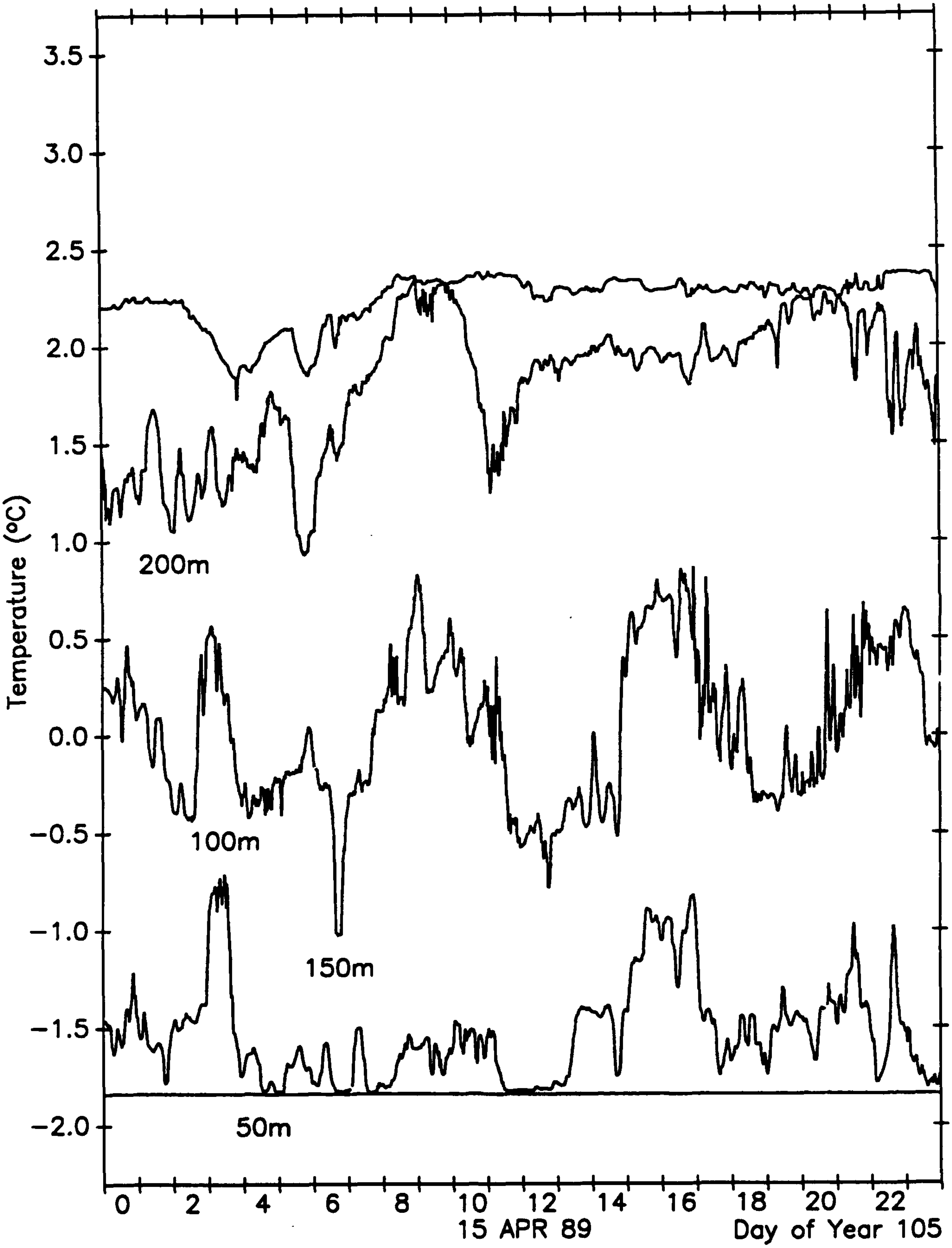

CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
200m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
12 APR 89
Day of Year 102

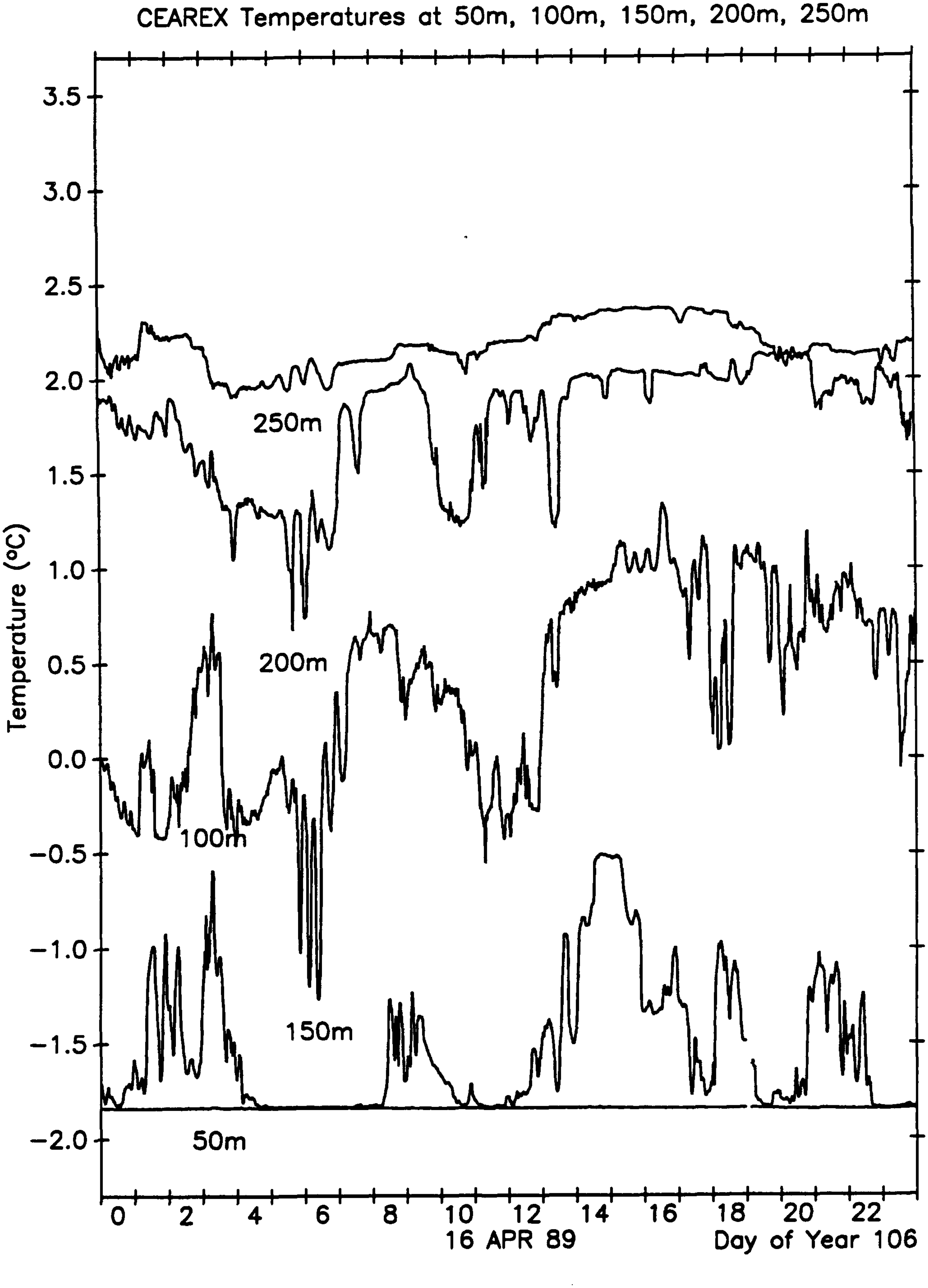

CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
Temperature (°C)
200m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
13 APR 89
Day of Year 103

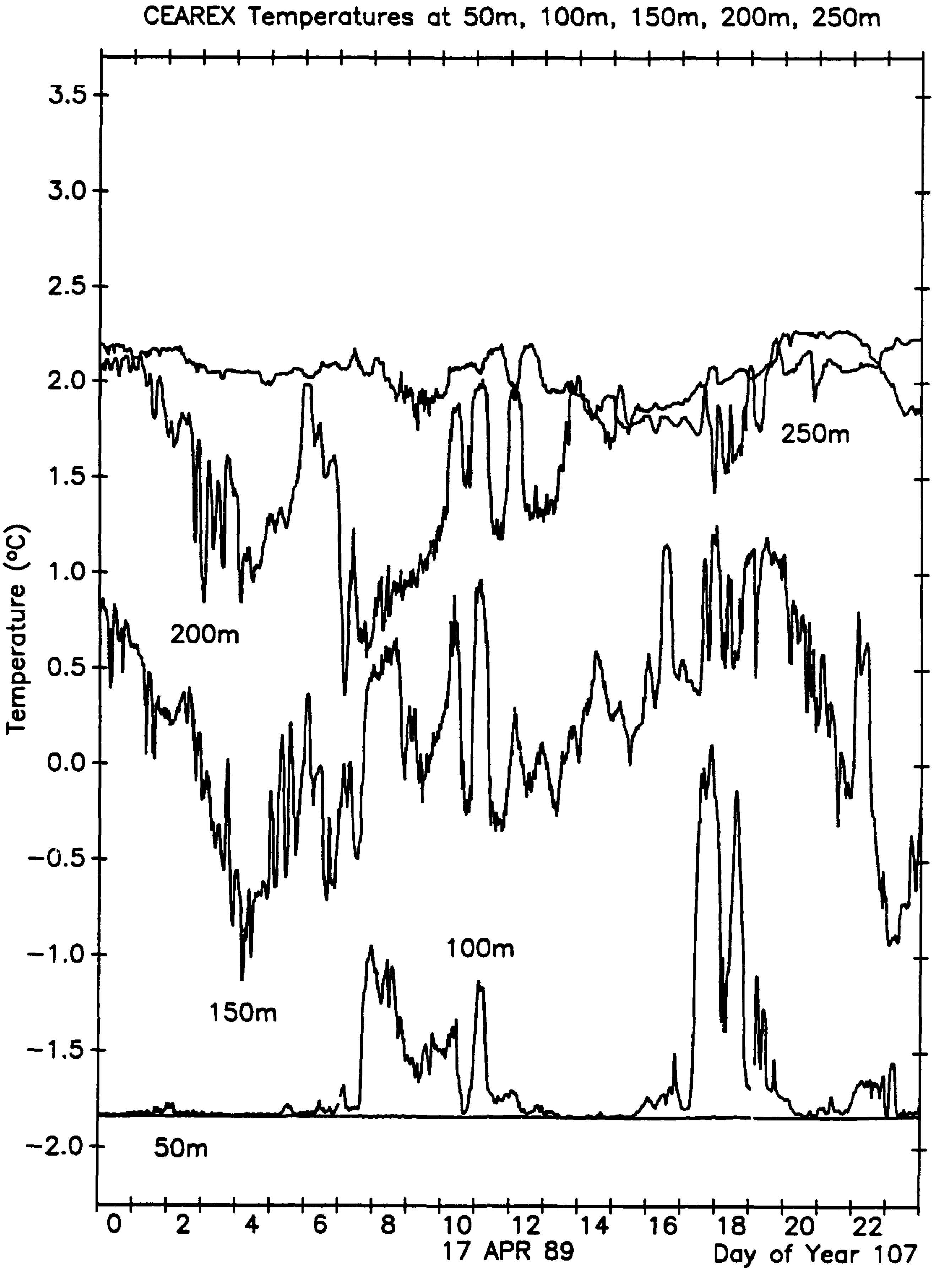
CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m



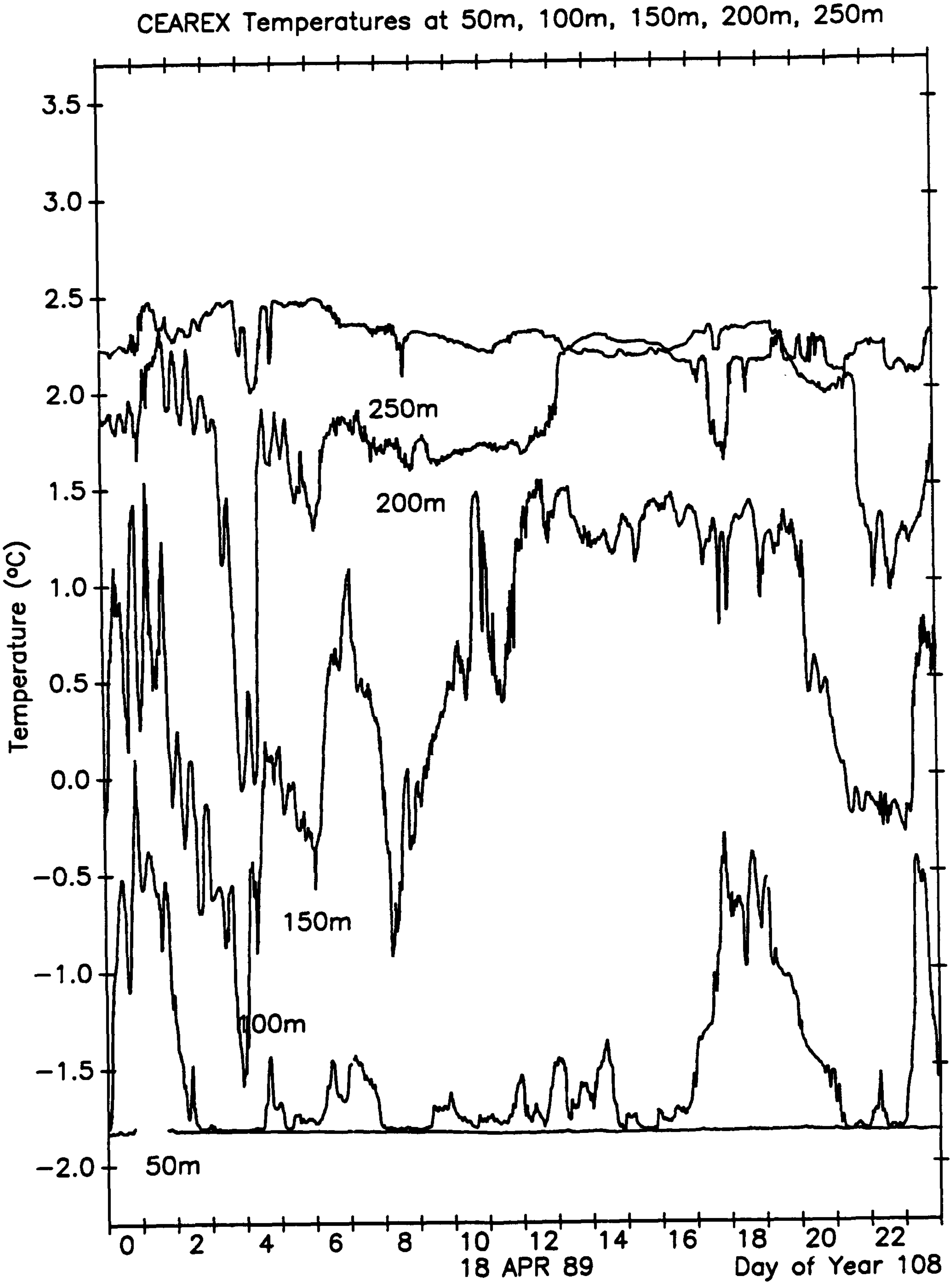
CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m



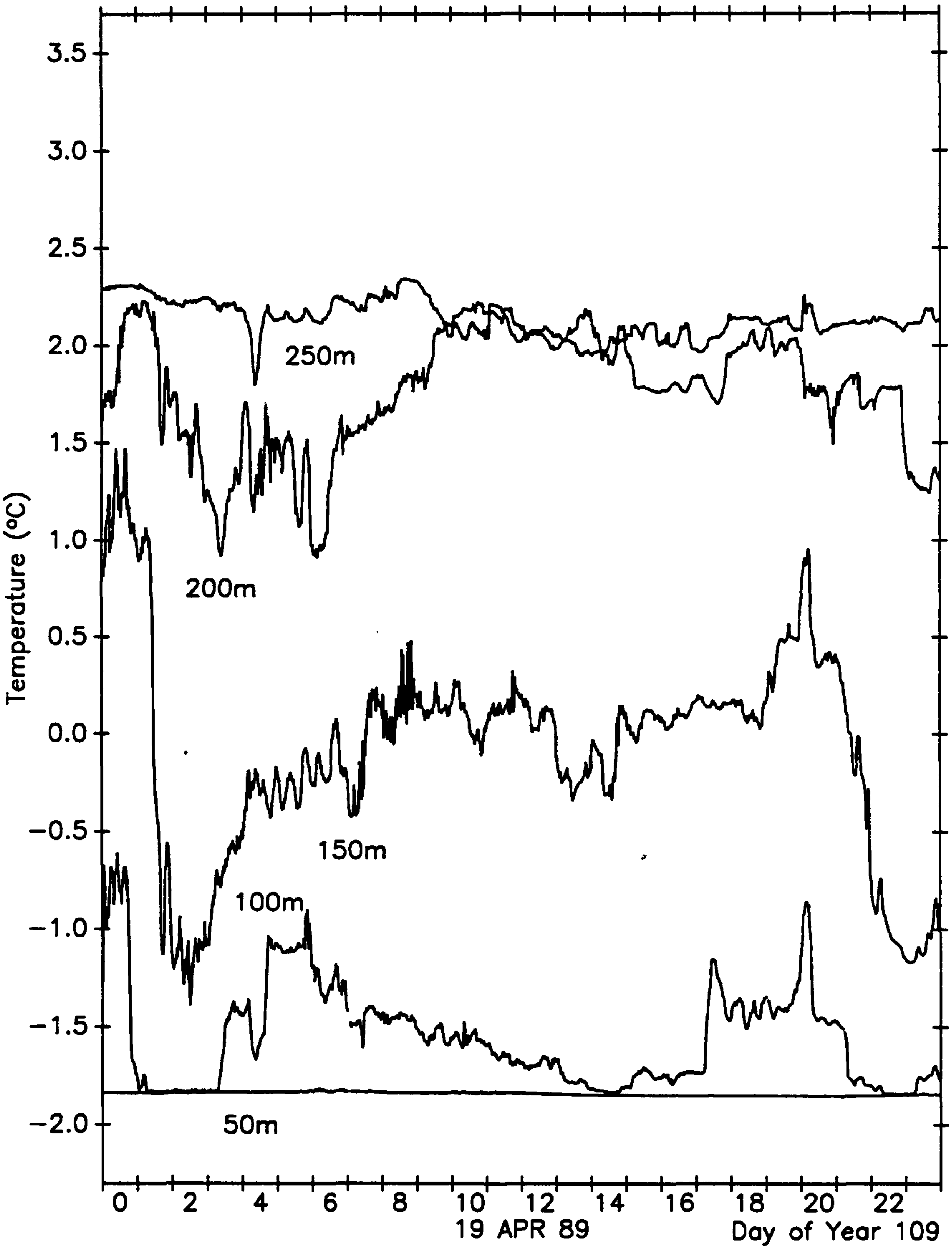

CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
250m
200m
100m
150m
50m
0
2
4
6
8
10
12
14
16
18
20
22
16 APR 89
Day of Year 106



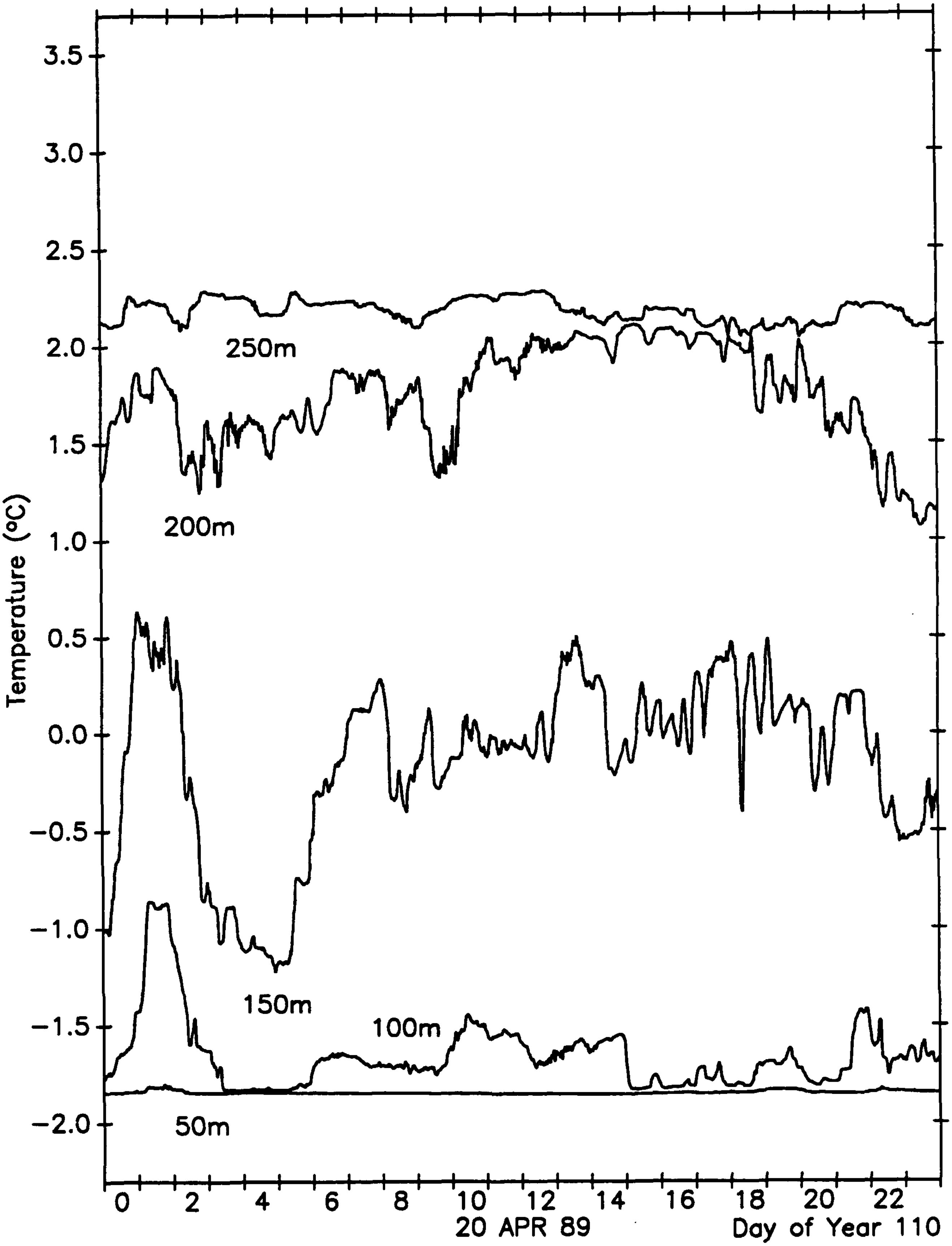
CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
250m
200m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
17 APR 89
Day of Year 107


CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
250m
200m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
18 APR 89
Day of Year 108

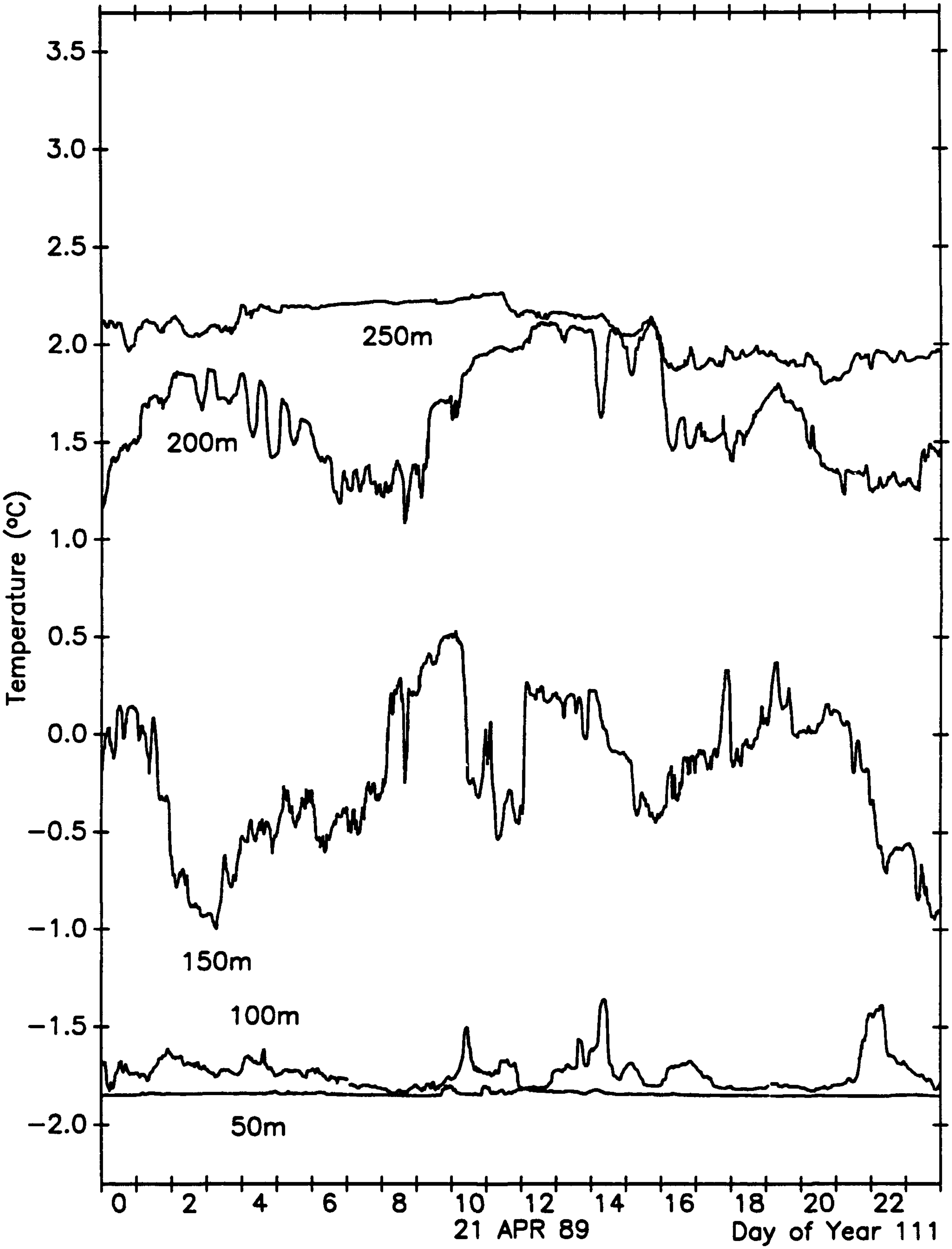
CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m

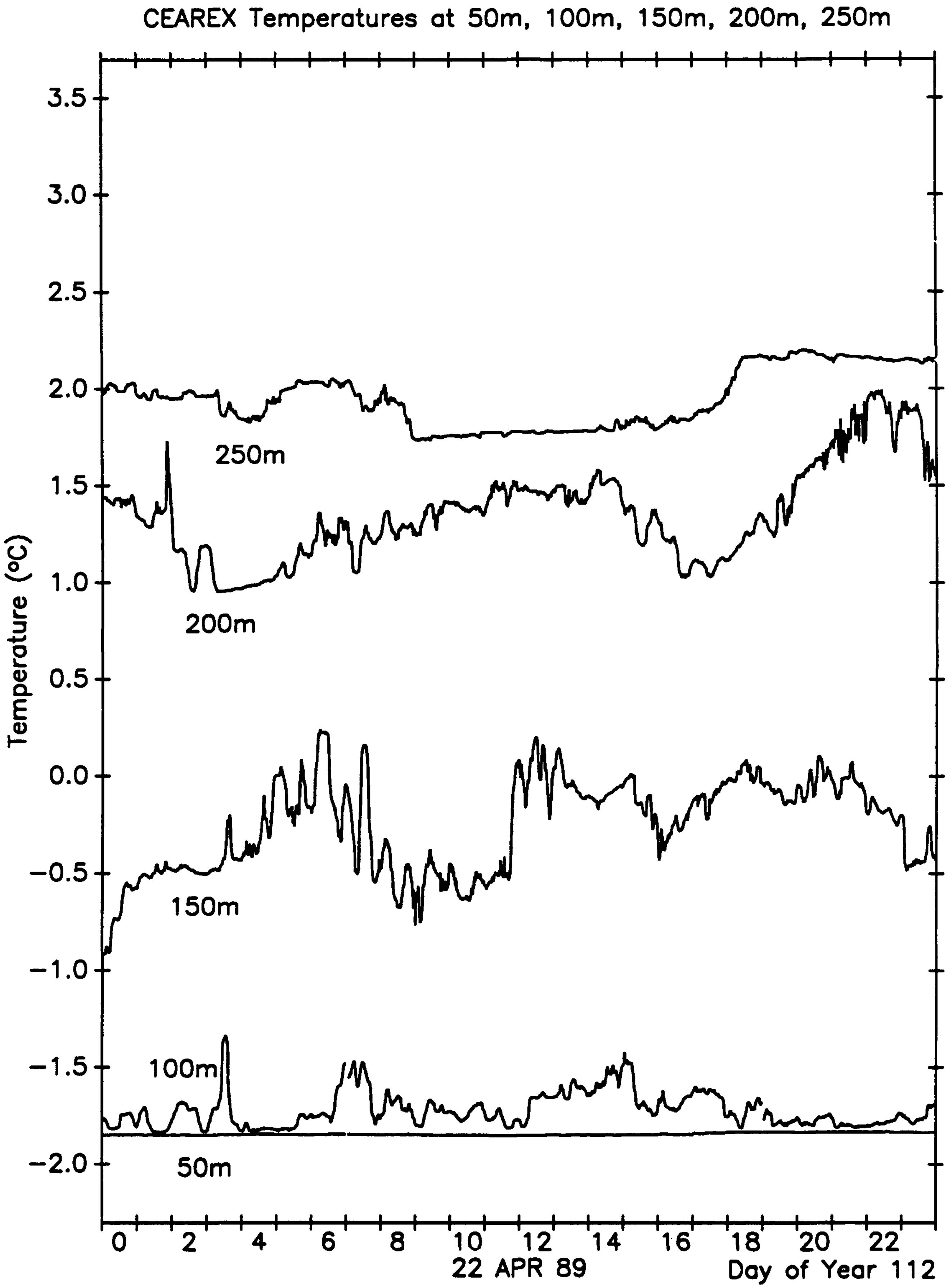


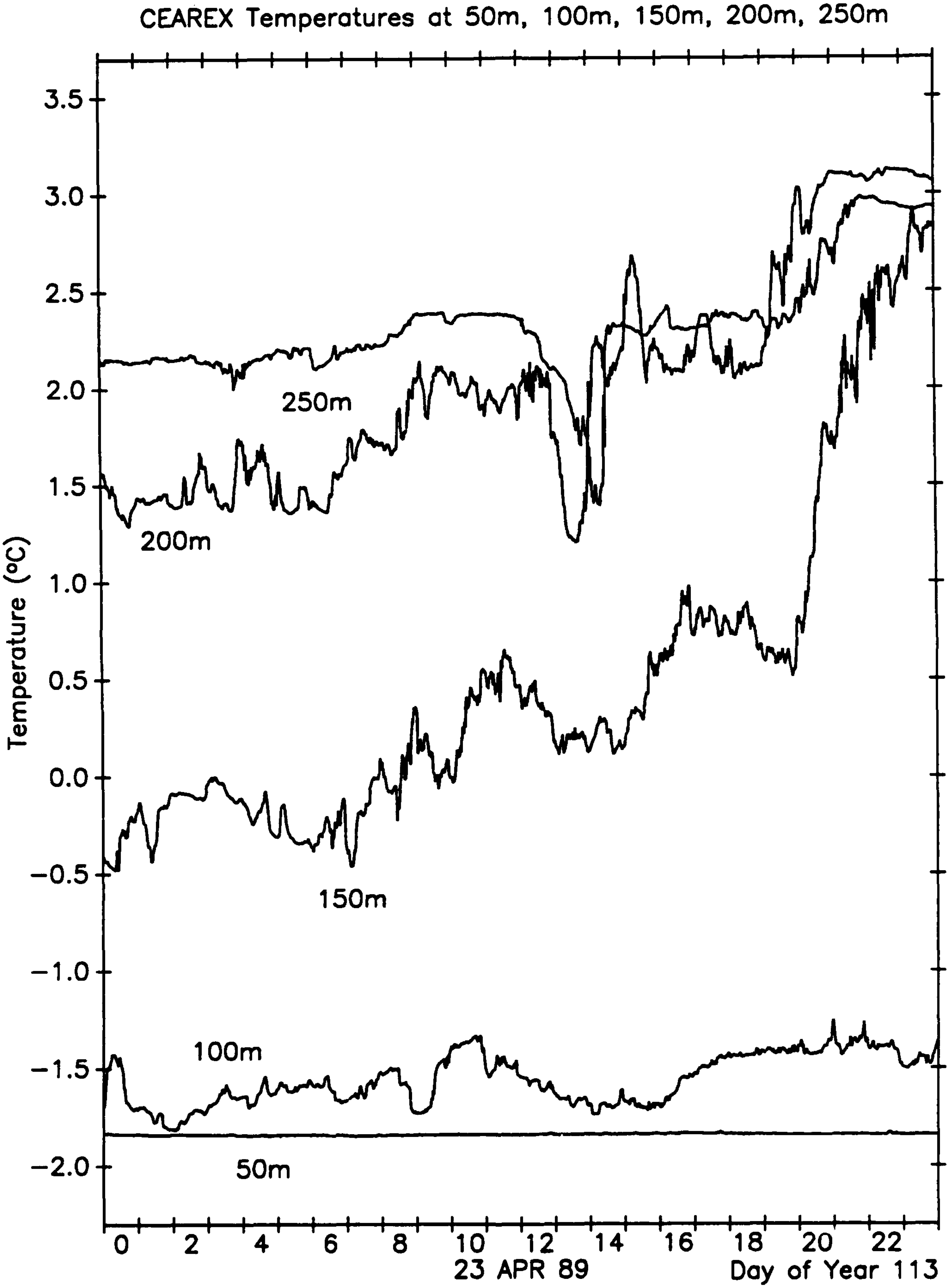
CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m



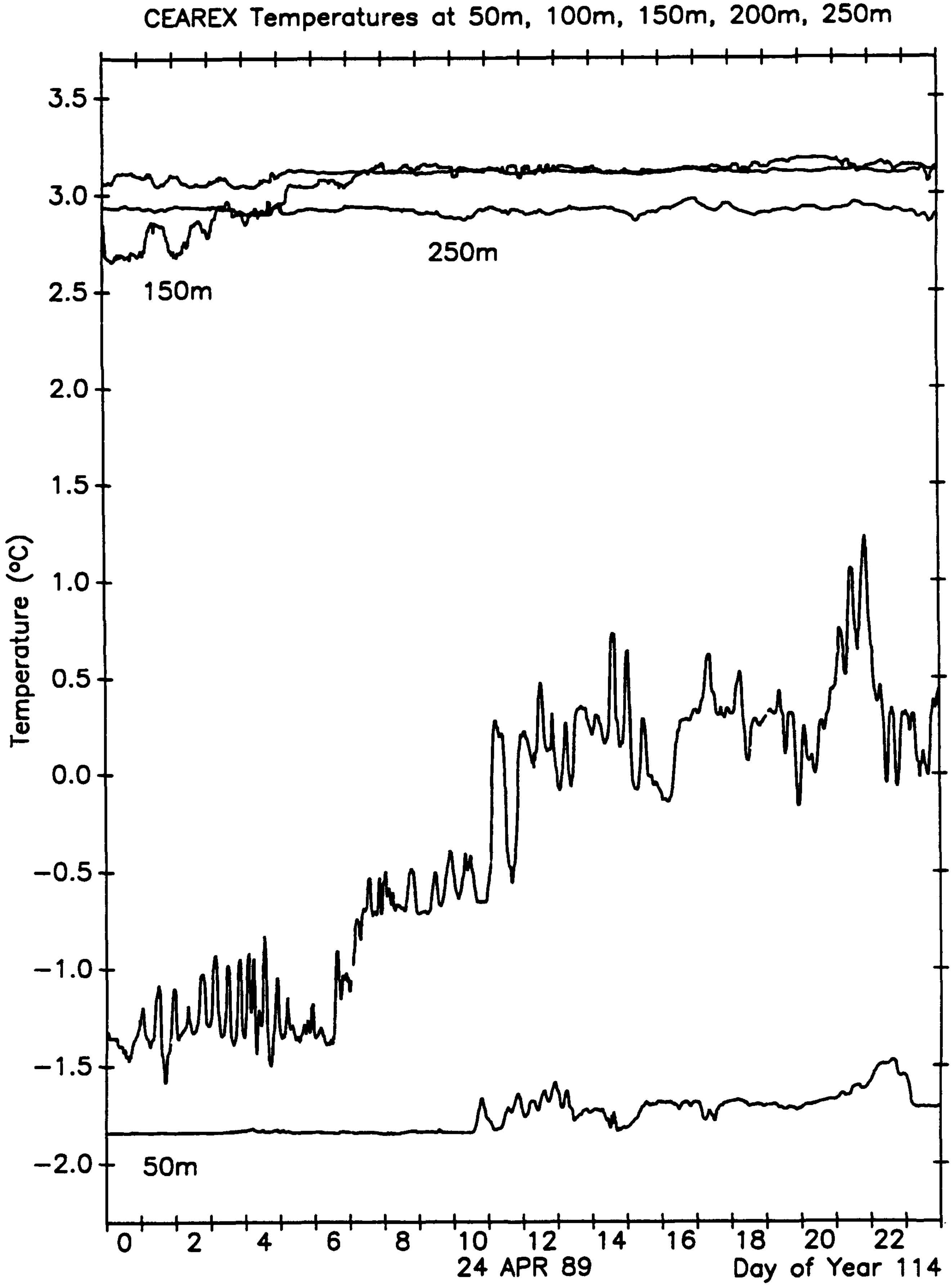
CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m



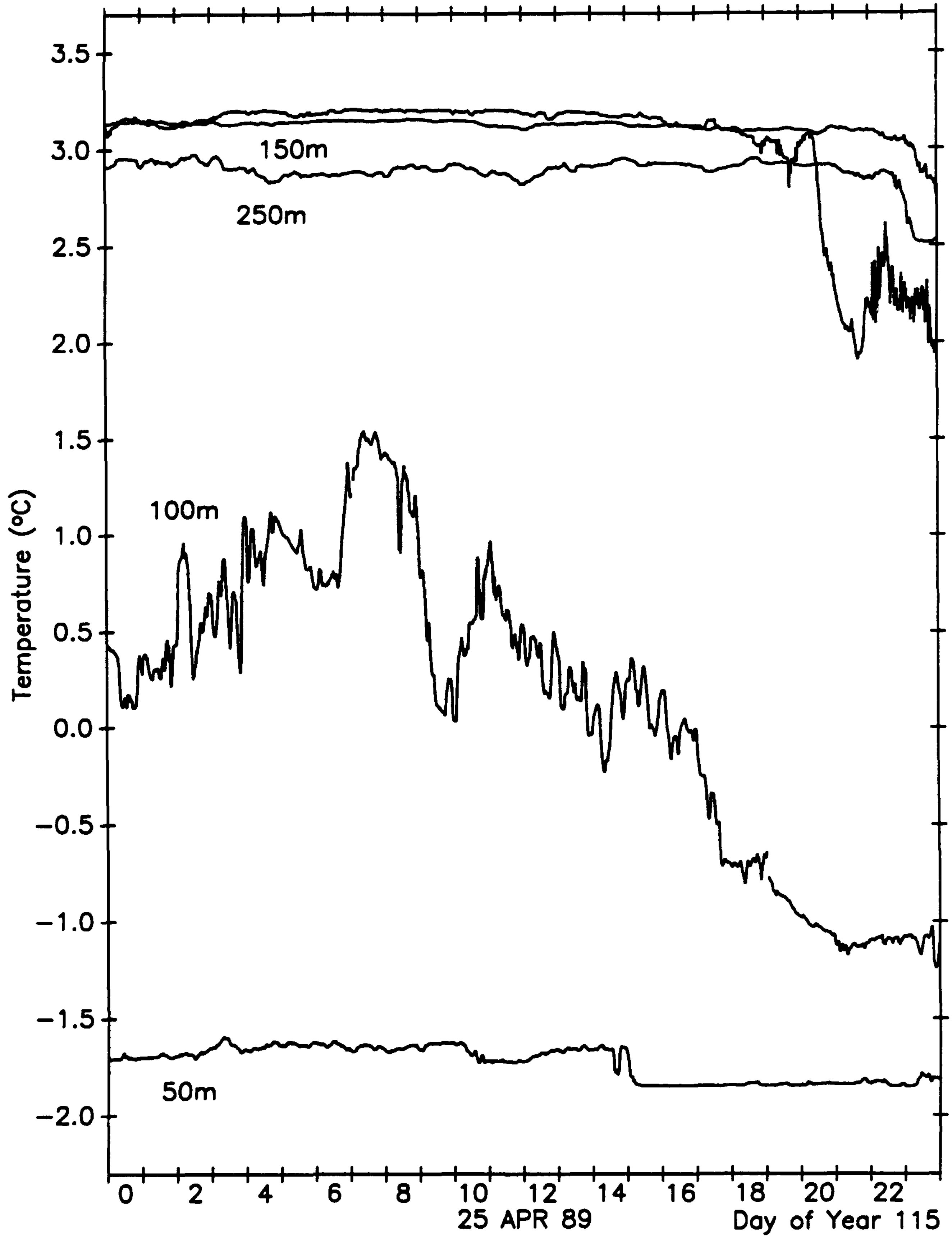

CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
250m
200m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
22 APR 89
Day of Year 112

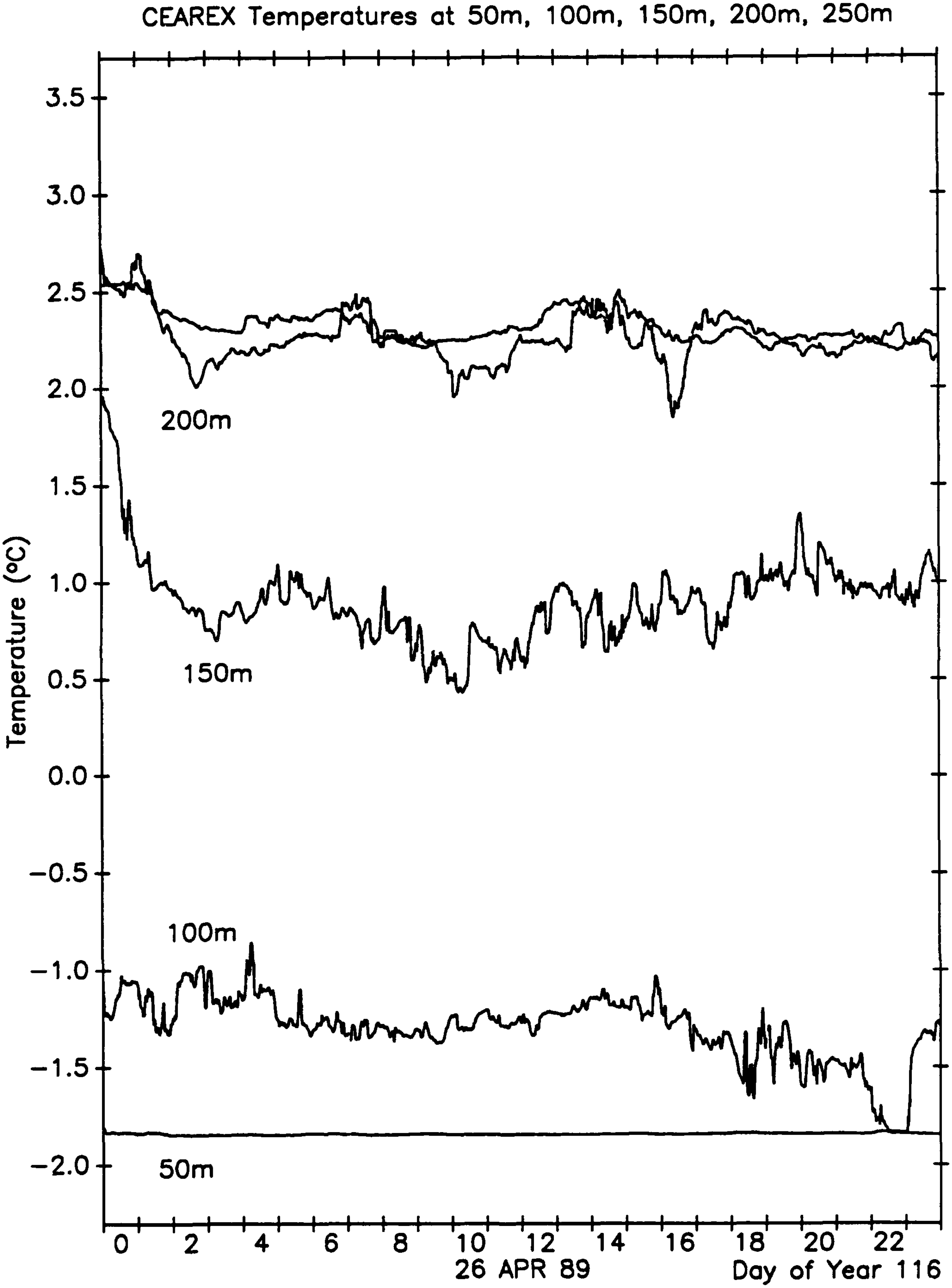


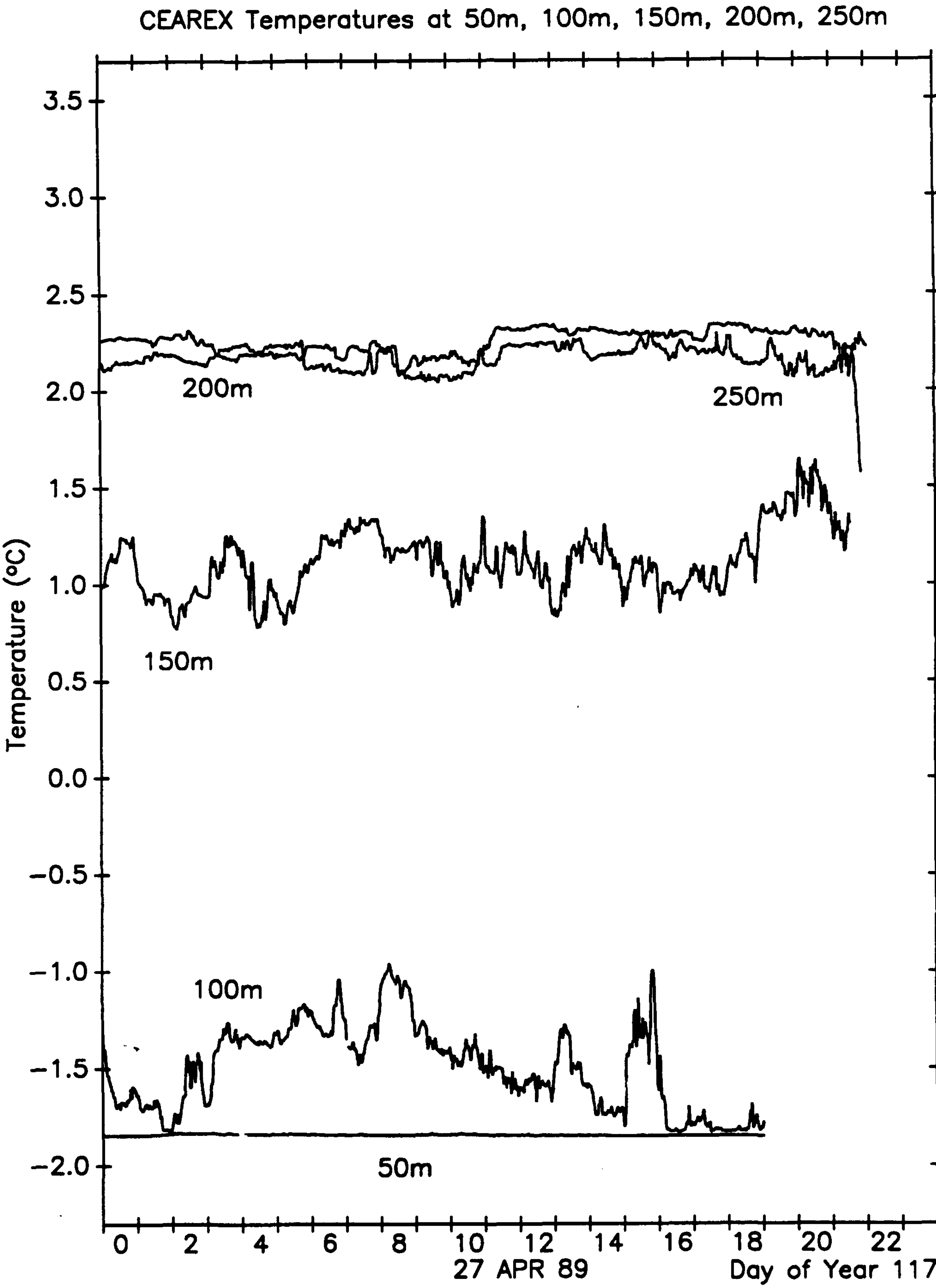
CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
250m
200m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
23 APR 89
Day of Year 113


CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
Temperature (°C)
250m
150m
50m
0
2
4
6
8
10
12
14
16
18
20
22
24 APR 89
Day of Year 114

CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m

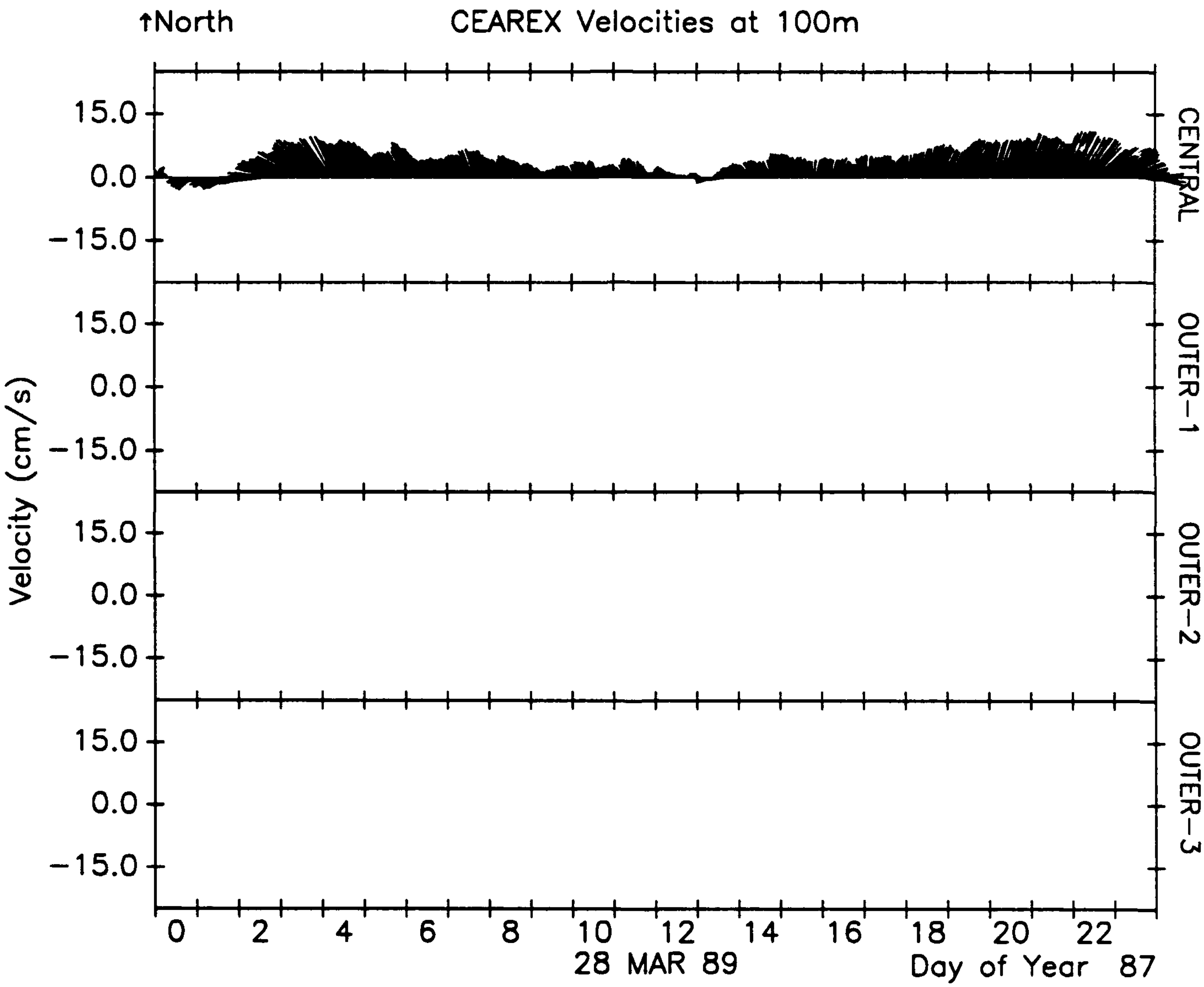


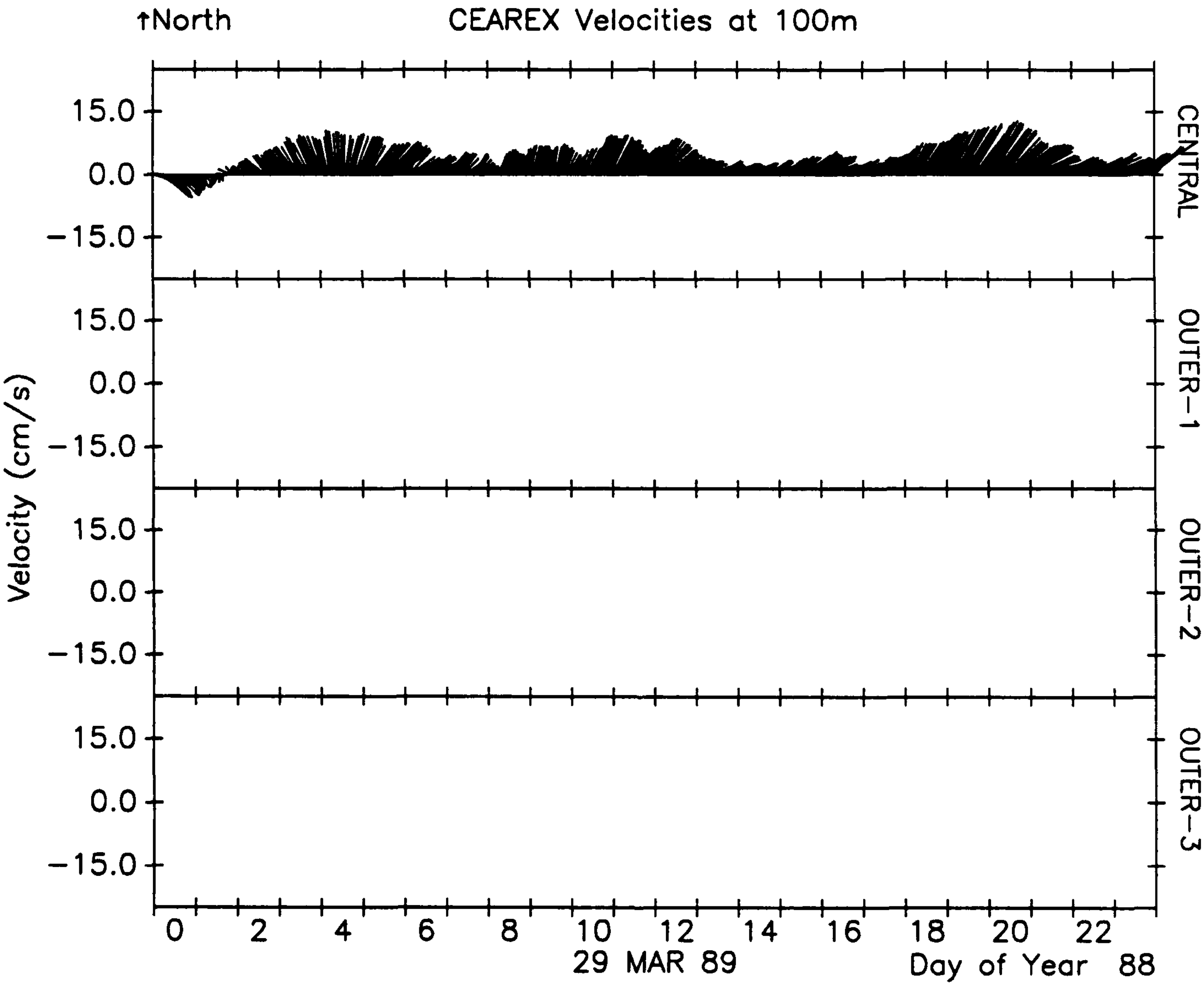

CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
200m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
26 APR 89
Day of Year 116

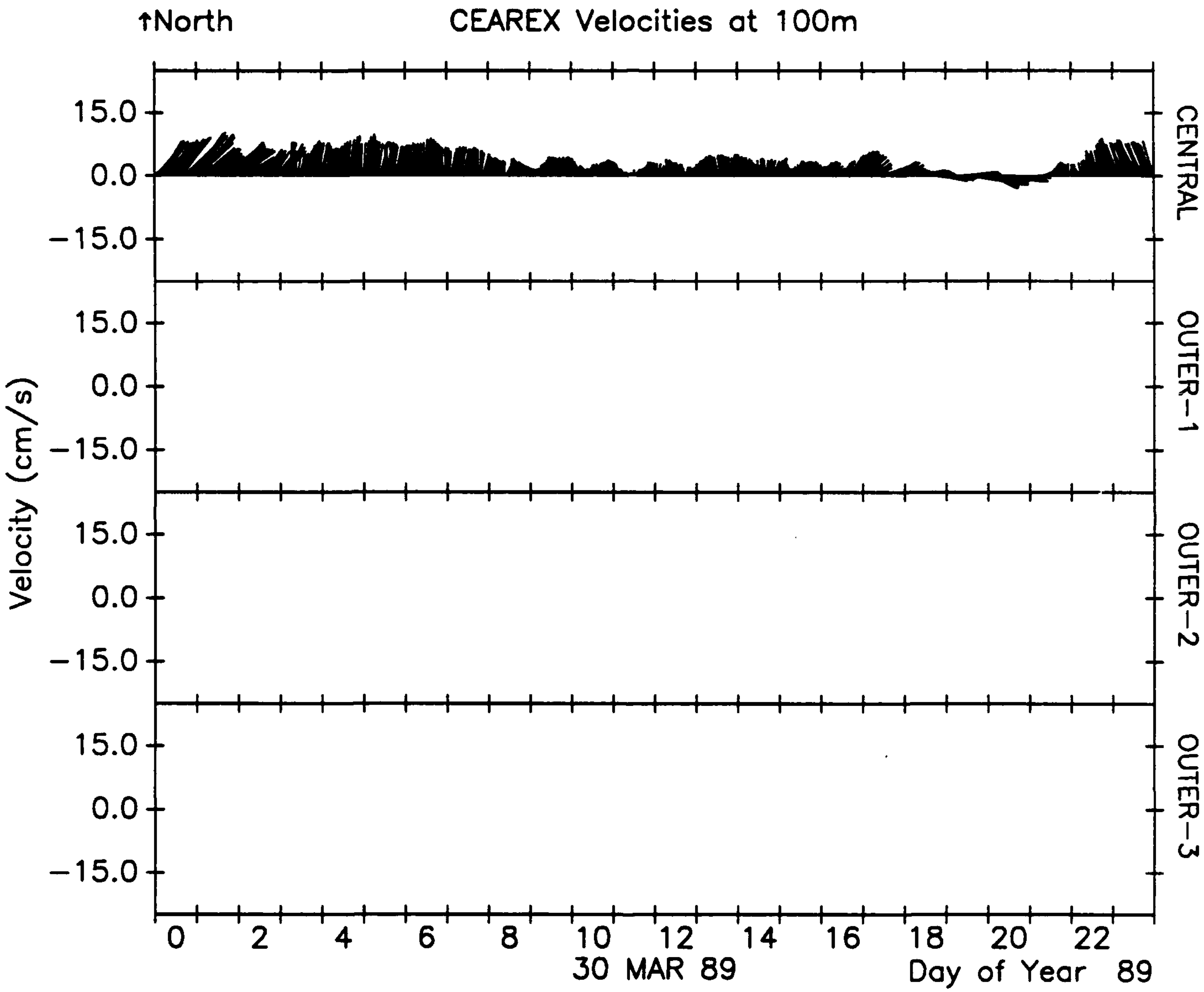

CEAREX Temperatures at 50m, 100m, 150m, 200m, 250m
Temperature (°C)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
200m
250m
150m
100m
50m
0
2
4
6
8
10
12
14
16
18
20
22
27 APR 89
Day of Year 117

TIME SERIES OF VELOCITY AT 100 m: UNFILTERED

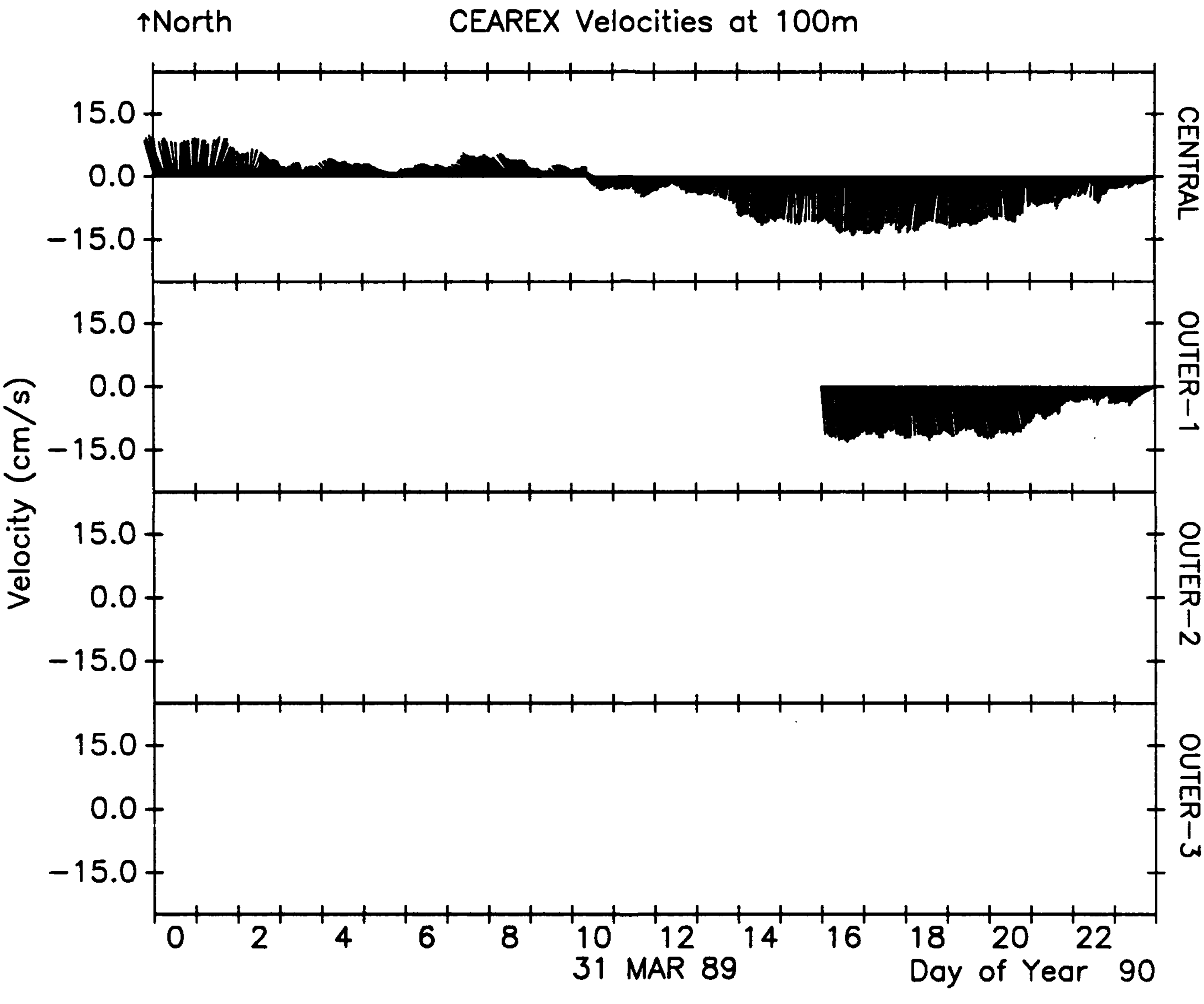
On the following 31 pages are observations of velocity at 100 m depth from the Central, O1, O2, and O3 moorings. These data were recorded by S-4 current meters. Note: absolute velocities are presented after the start of April 4; relative velocities are shown before. (See Tables 1 and 3).

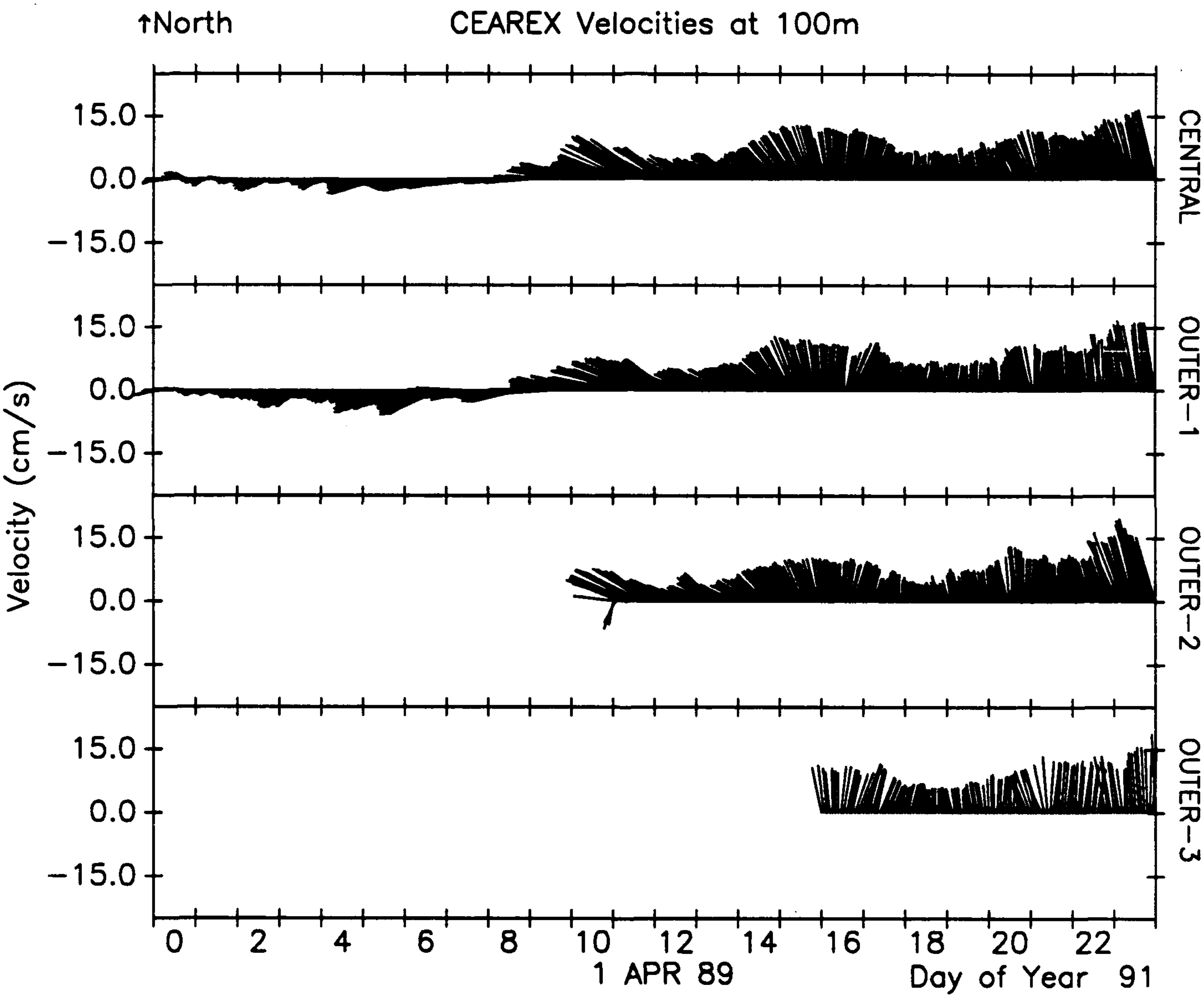

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
28 MAR 89
Day of Year 87

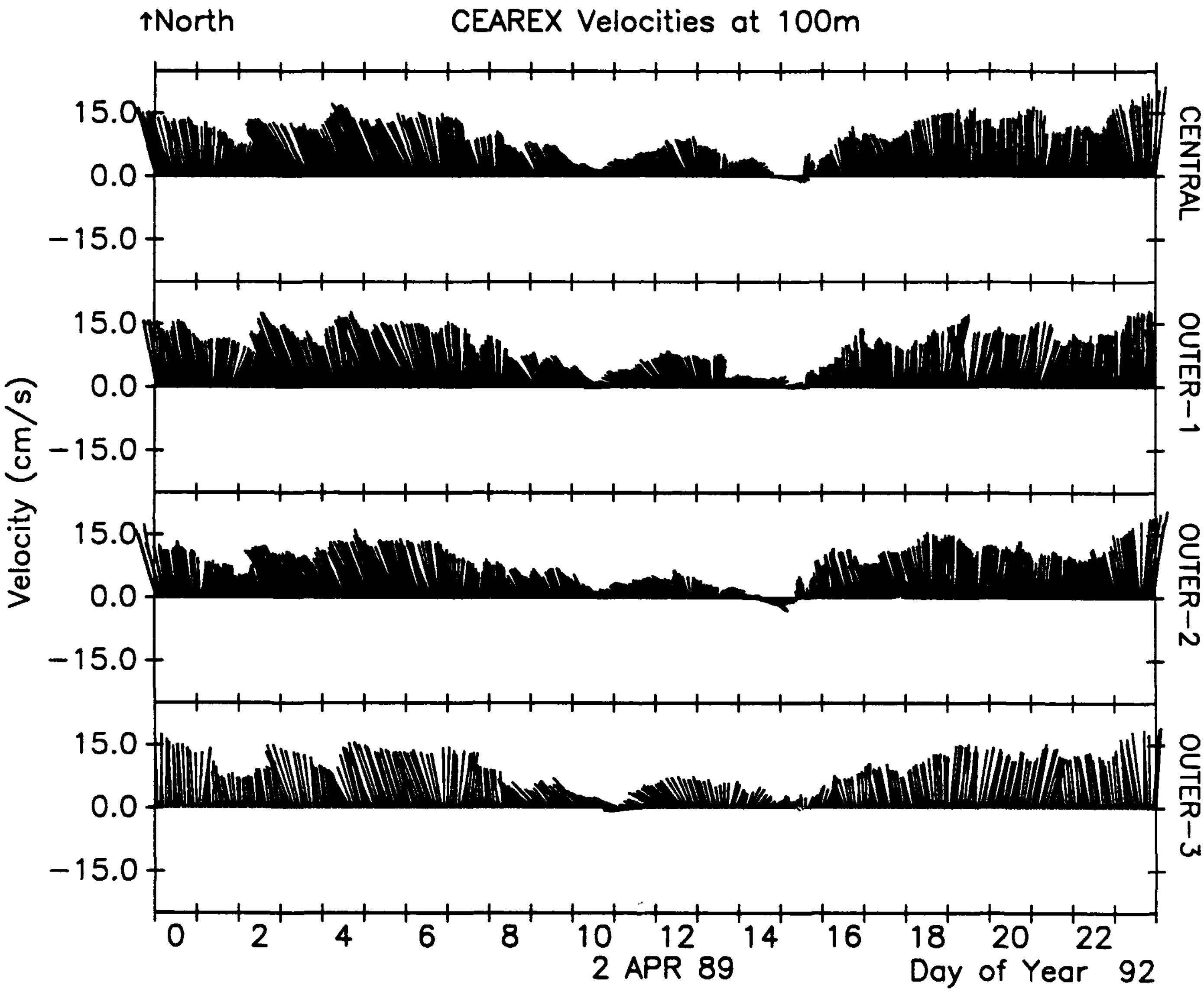

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
Velocity (cm/s)
CENTRAL
OUTER−1
OUTER−2
OUTER−3
0 2 4 6 8 10 12 14 16 18 20 22
29 MAR 89
Day of Year 88

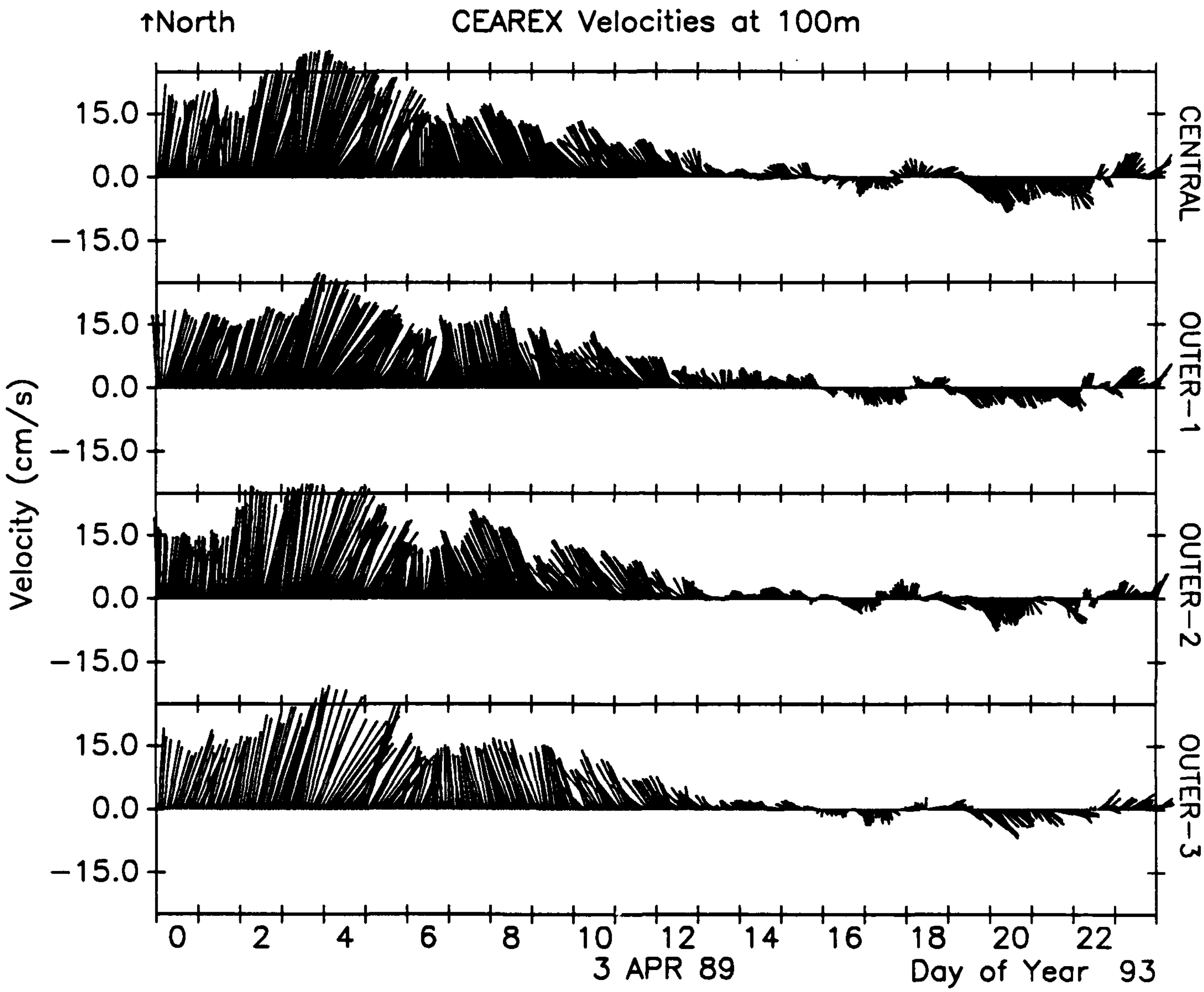


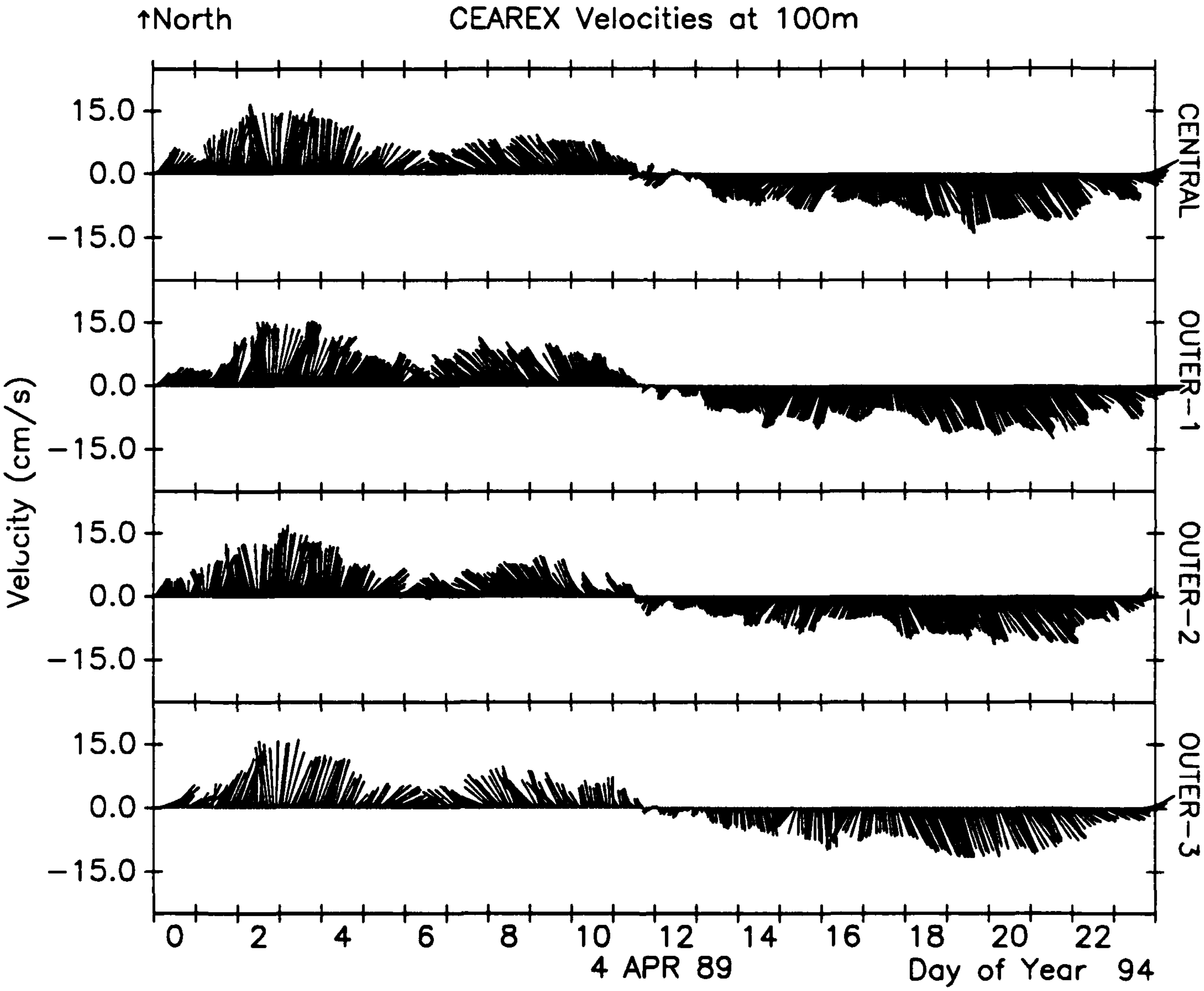
↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
30 MAR 89
Day of Year 89

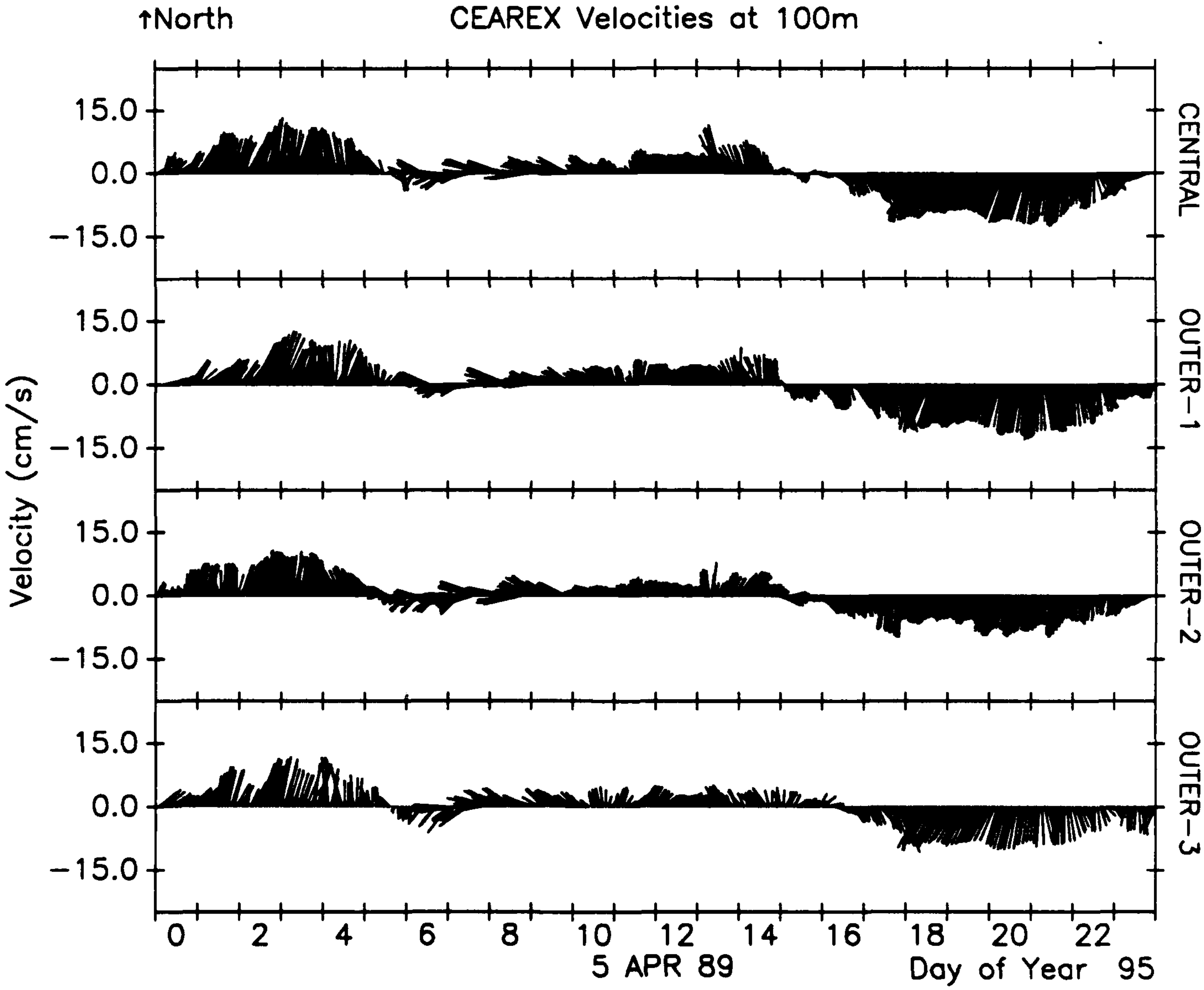

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
15.0
0.0
−15.0
15.0
0.0
−15.0
15.0
0.0
−15.0
Velocity (cm/s)
CENTRAL
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
31 MAR 89
Day of Year 90

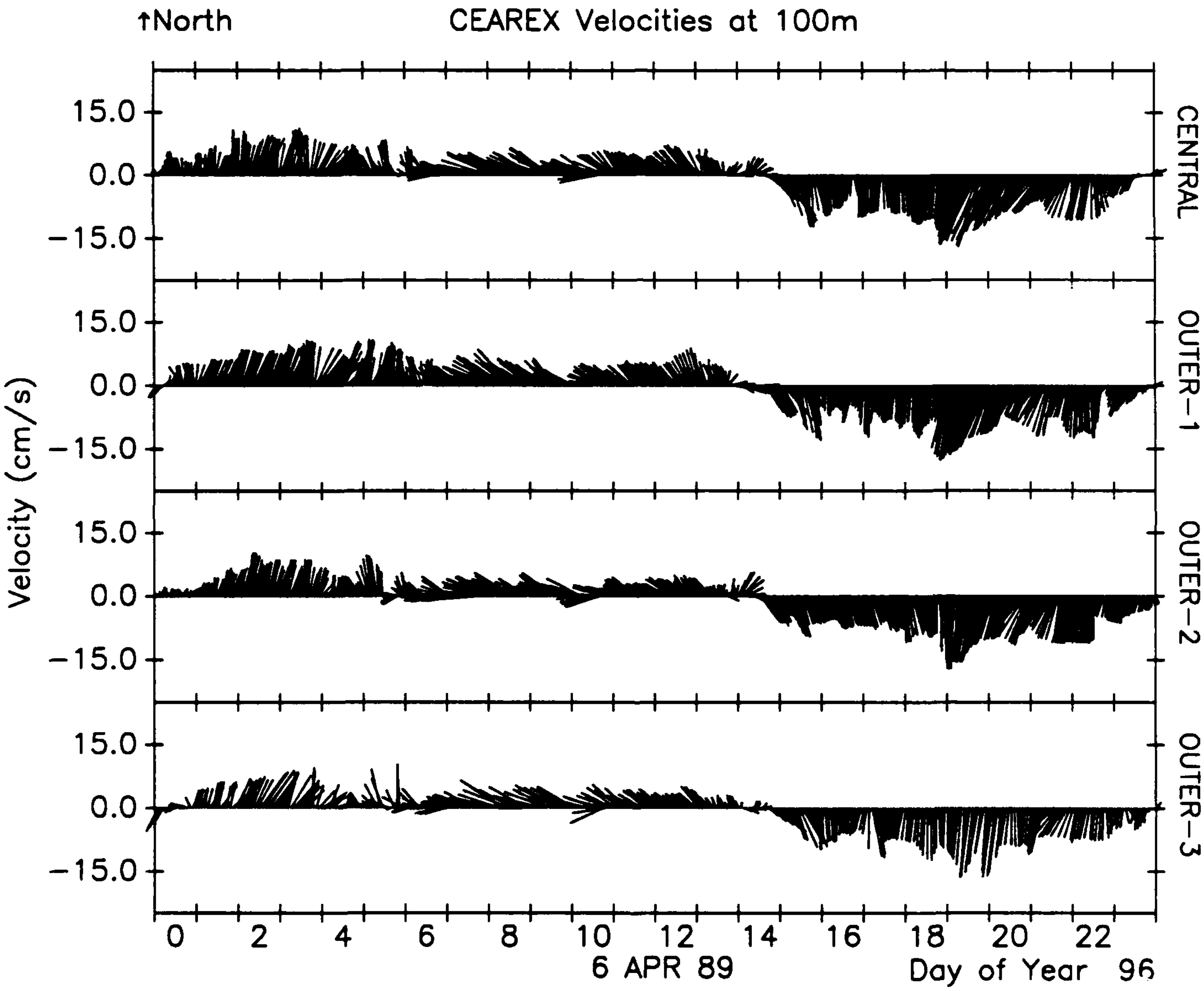

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
1 APR 89
Day of Year 91


↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
Velocity (cm/s)
CENTRAL
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
2 APR 89
Day of Year 92

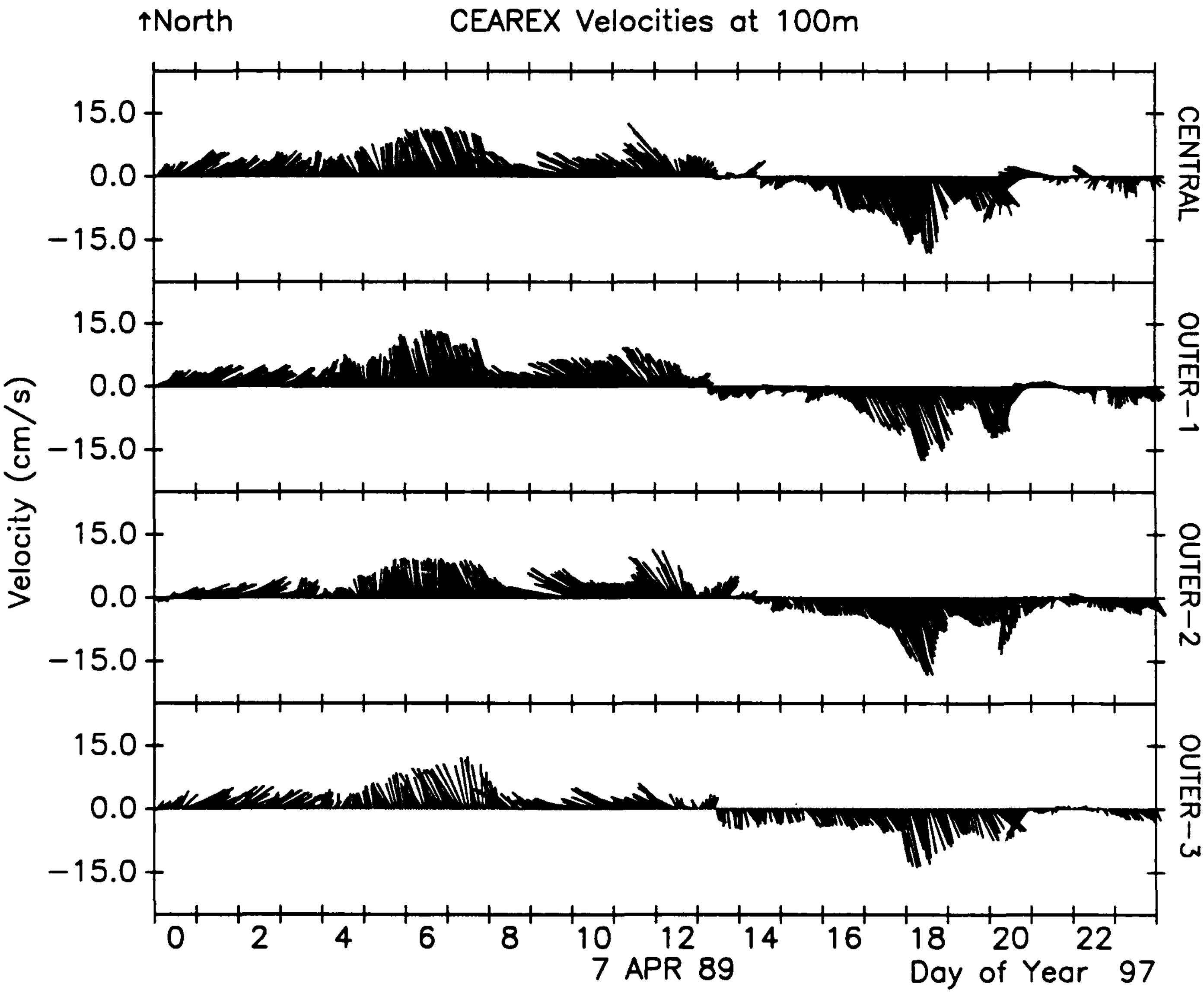

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
3 APR 89
Day of Year 93

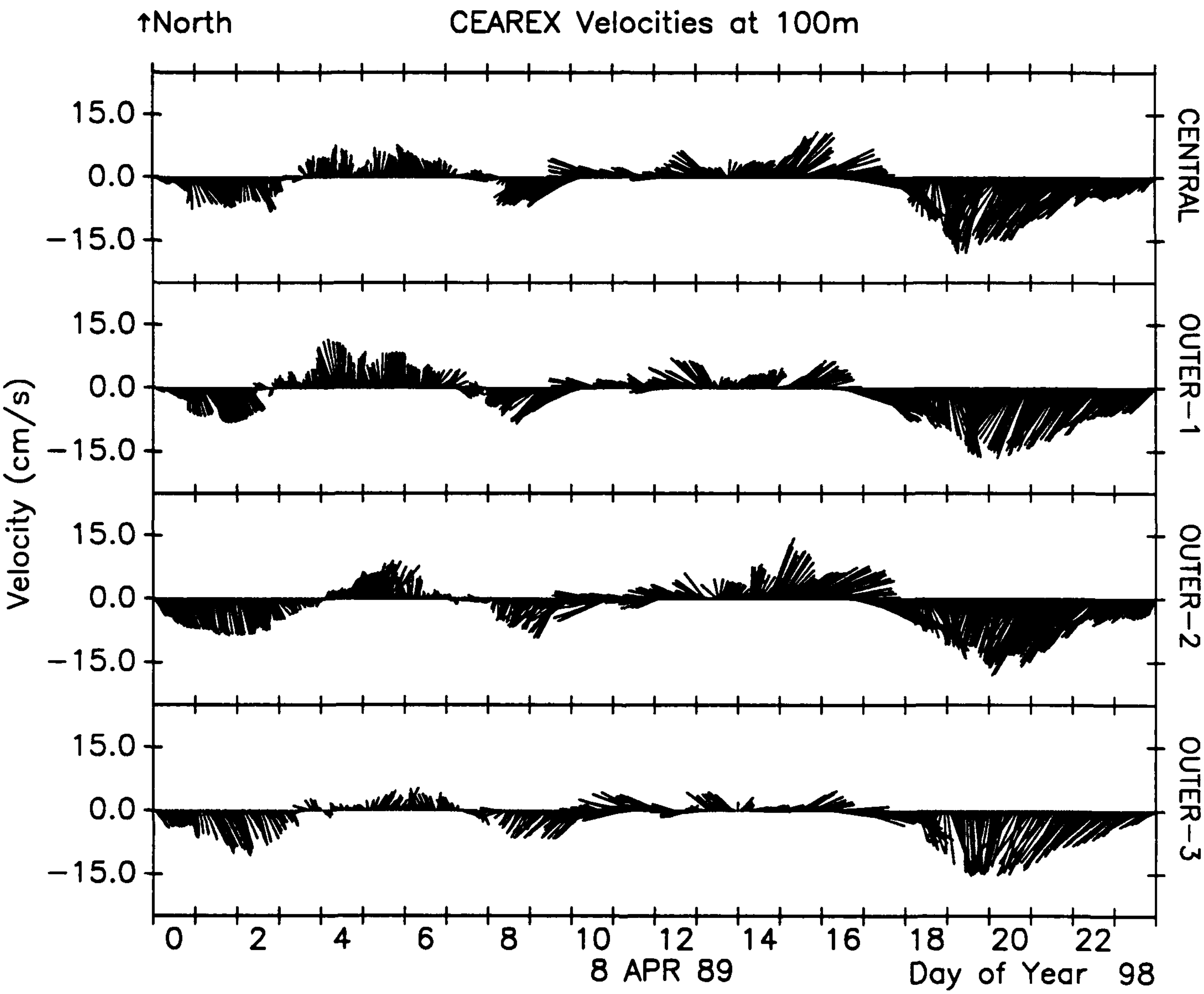

↑North
CEAREX Velocities at 100m
Velocity (cm/s)
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
0 2 4 6 8 10 12 14 16 18 20 22
4 APR 89
Day of Year 94

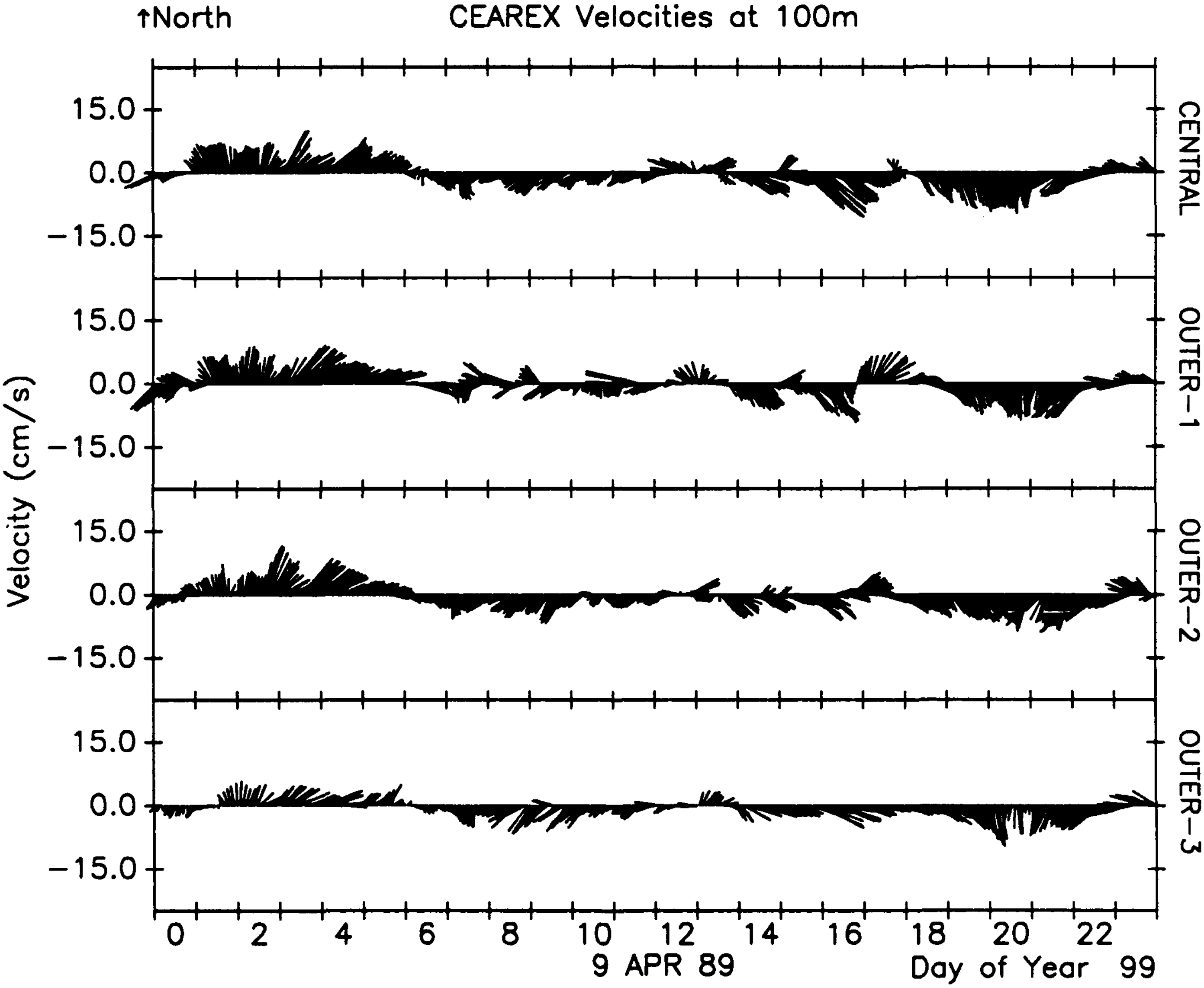

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
5 APR 89
Day of Year 95



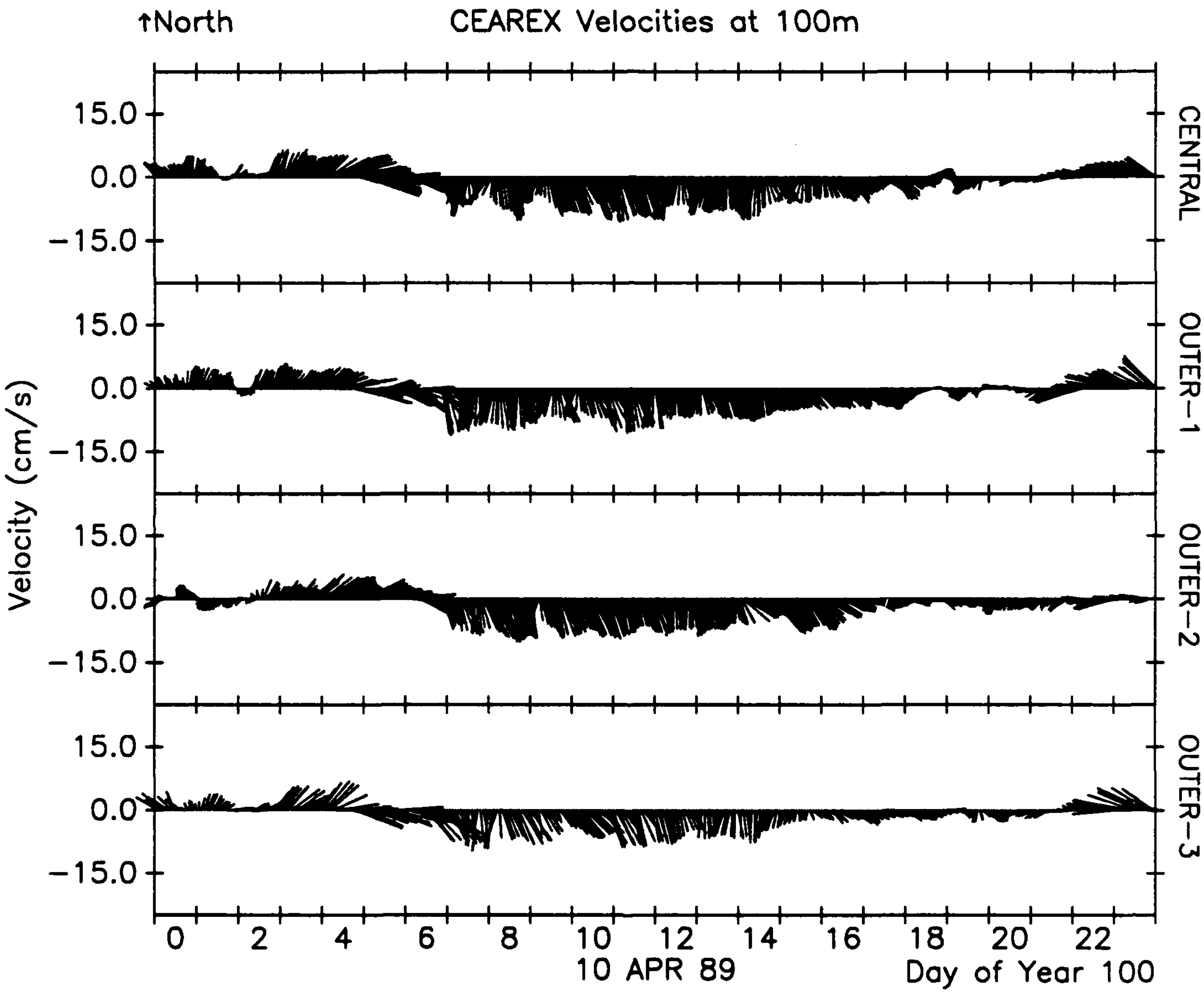
↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
6 APR 89
Day of Year 96

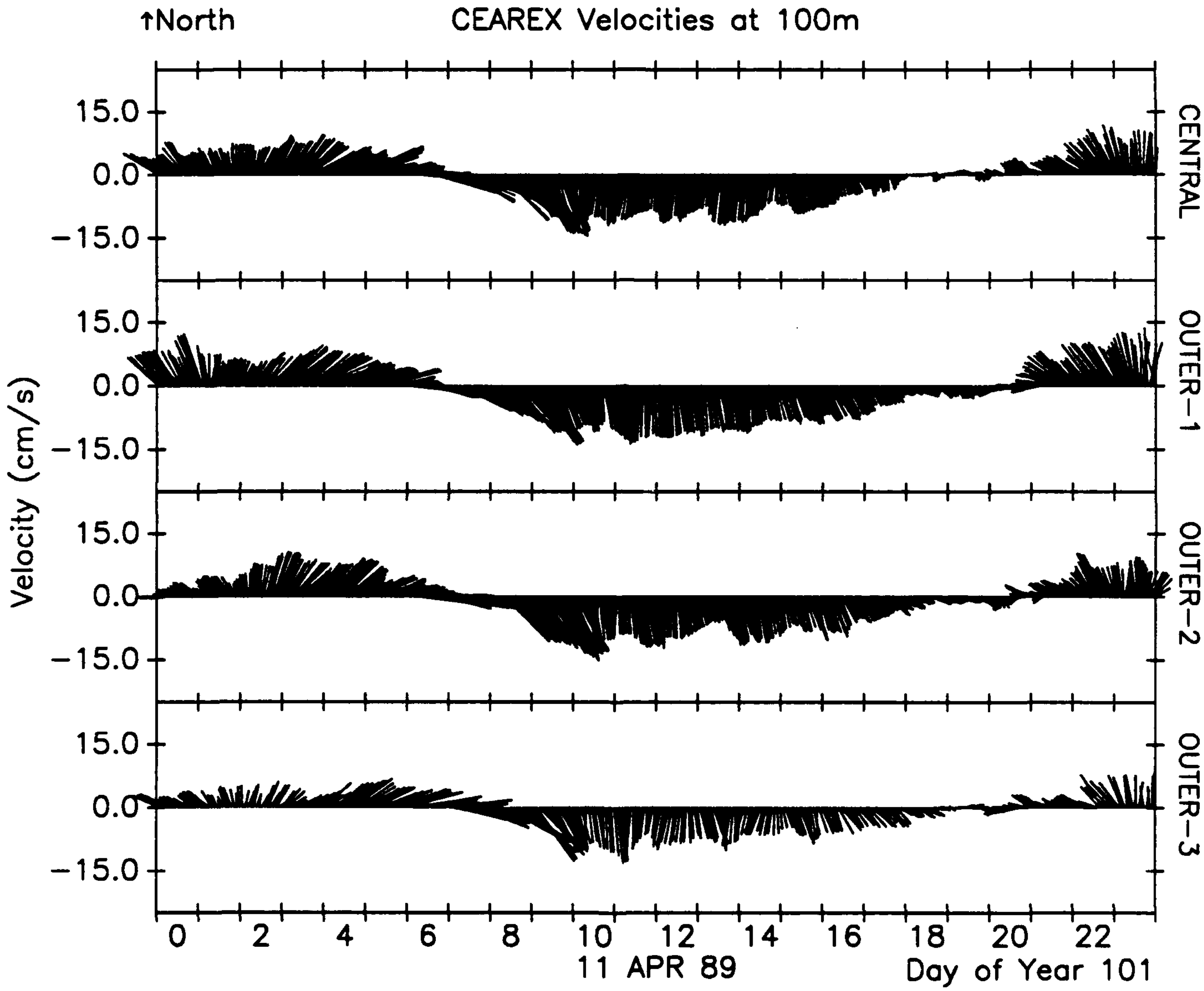

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
Velocity (cm/s)
CENTRAL
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
7 APR 89
Day of Year 97

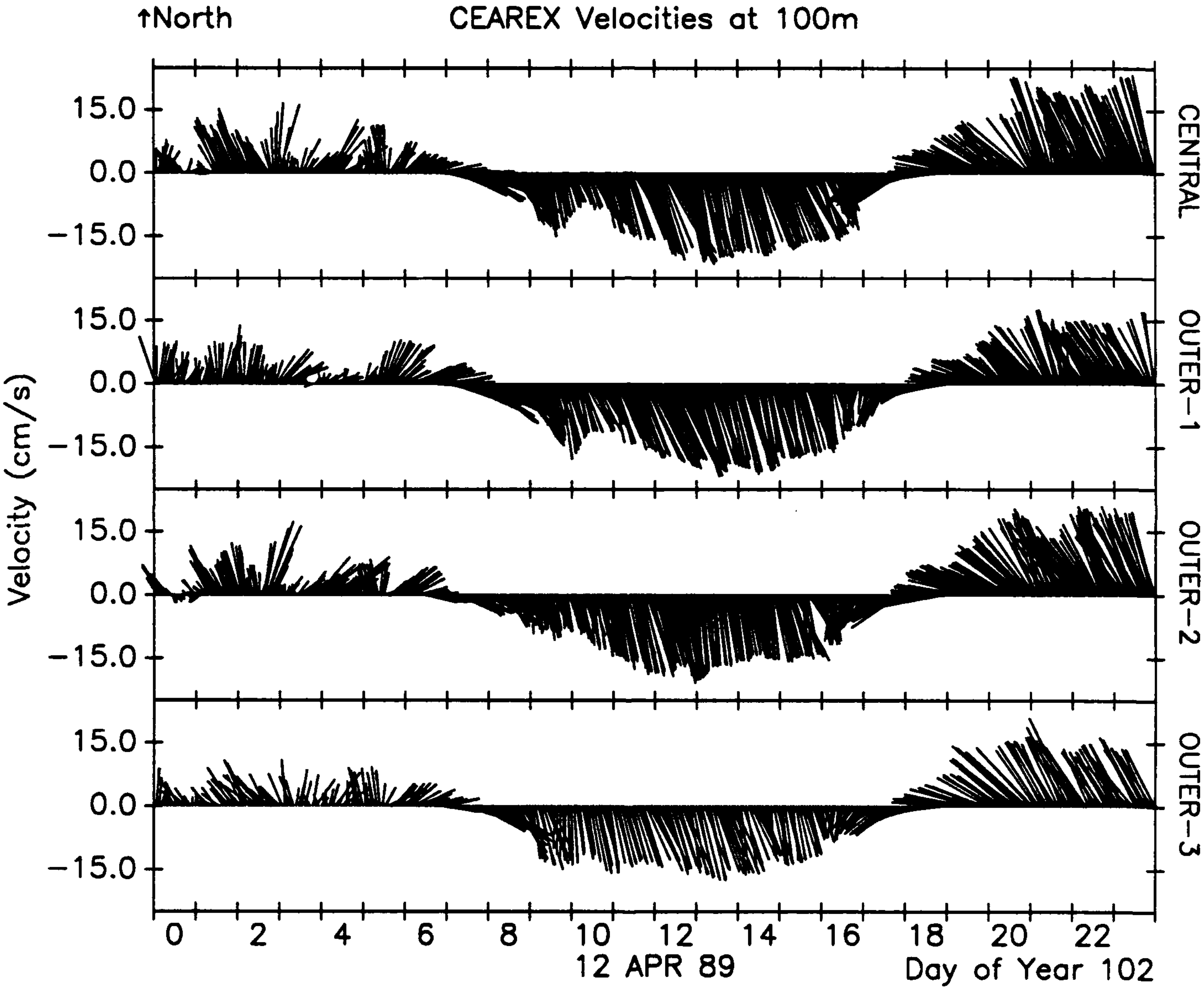

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
8 APR 89
Day of Year 98

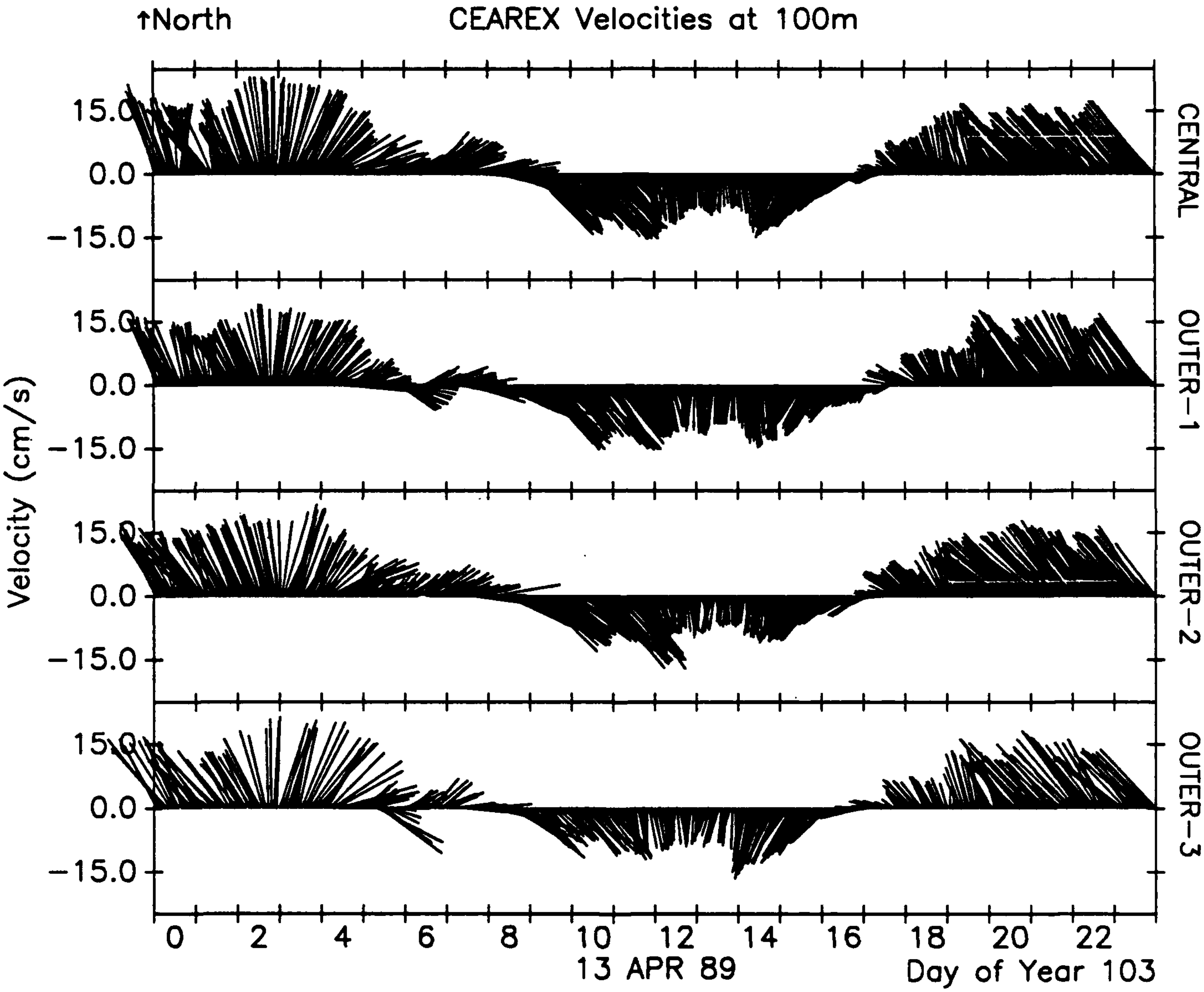


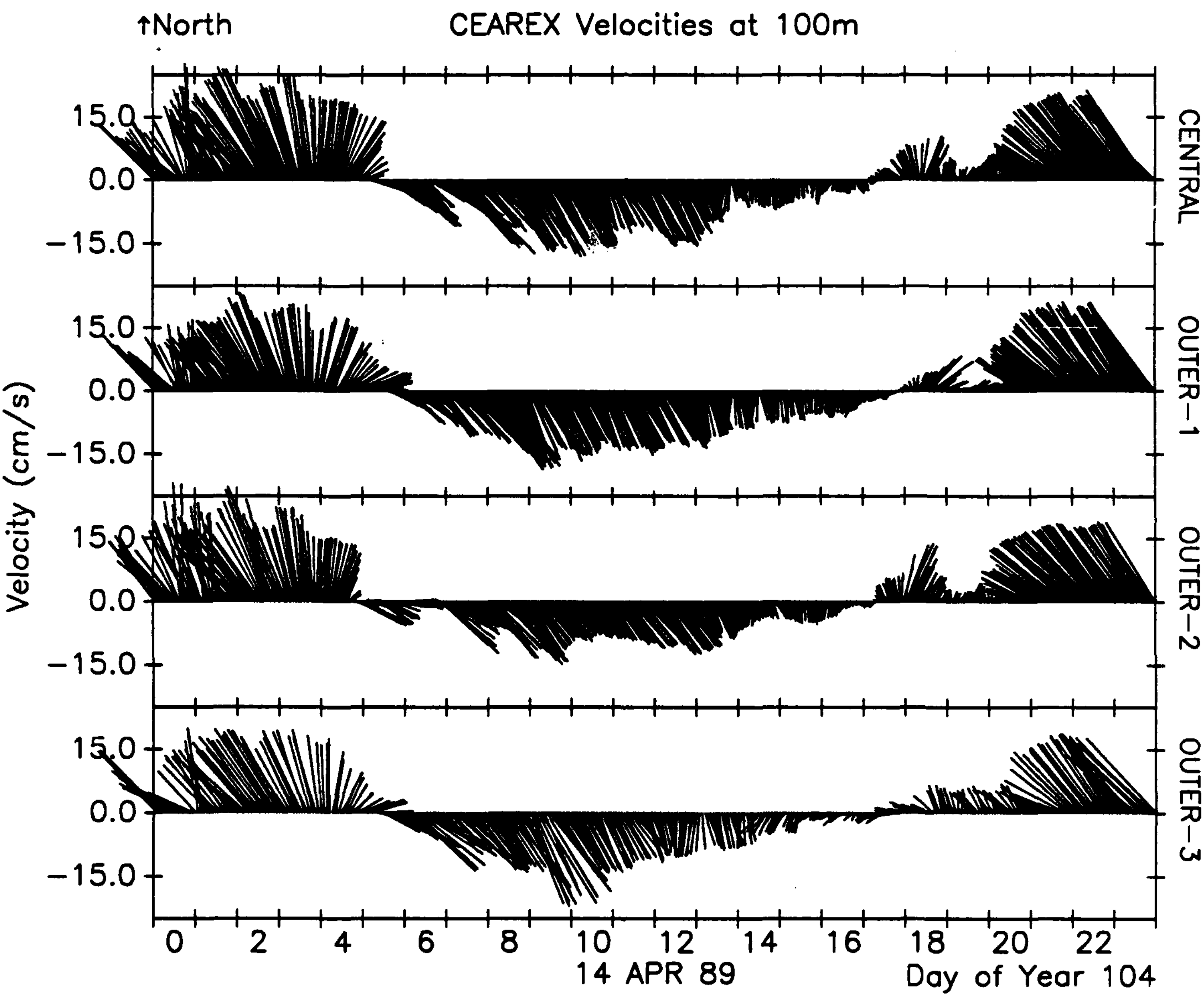
↑North
CEAREX Velocities at 100m
Velocity (cm/s)
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
9 APR 89
Day of Year 99

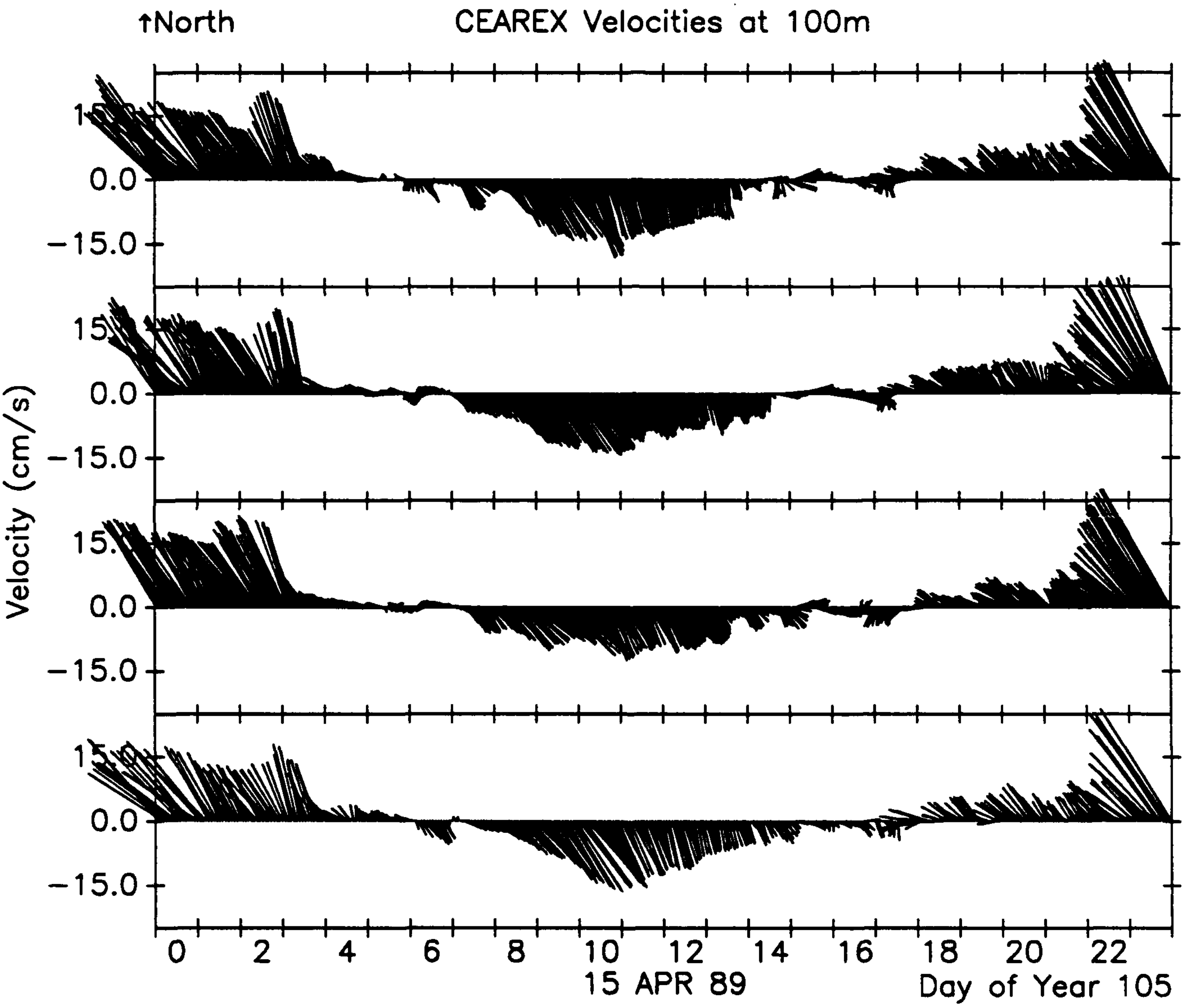

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
10 APR 89
Day of Year 100

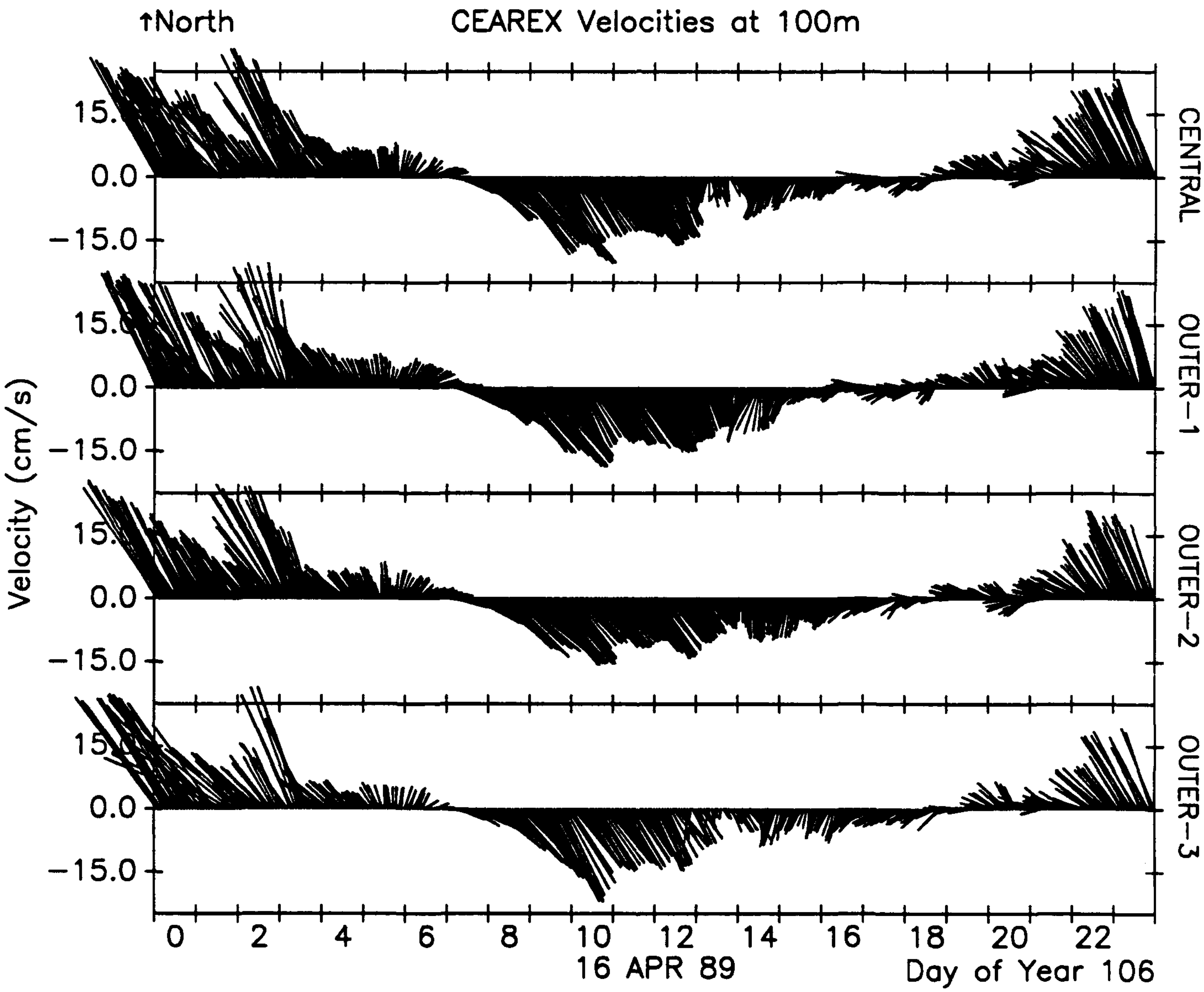

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
11 APR 89
Day of Year 101

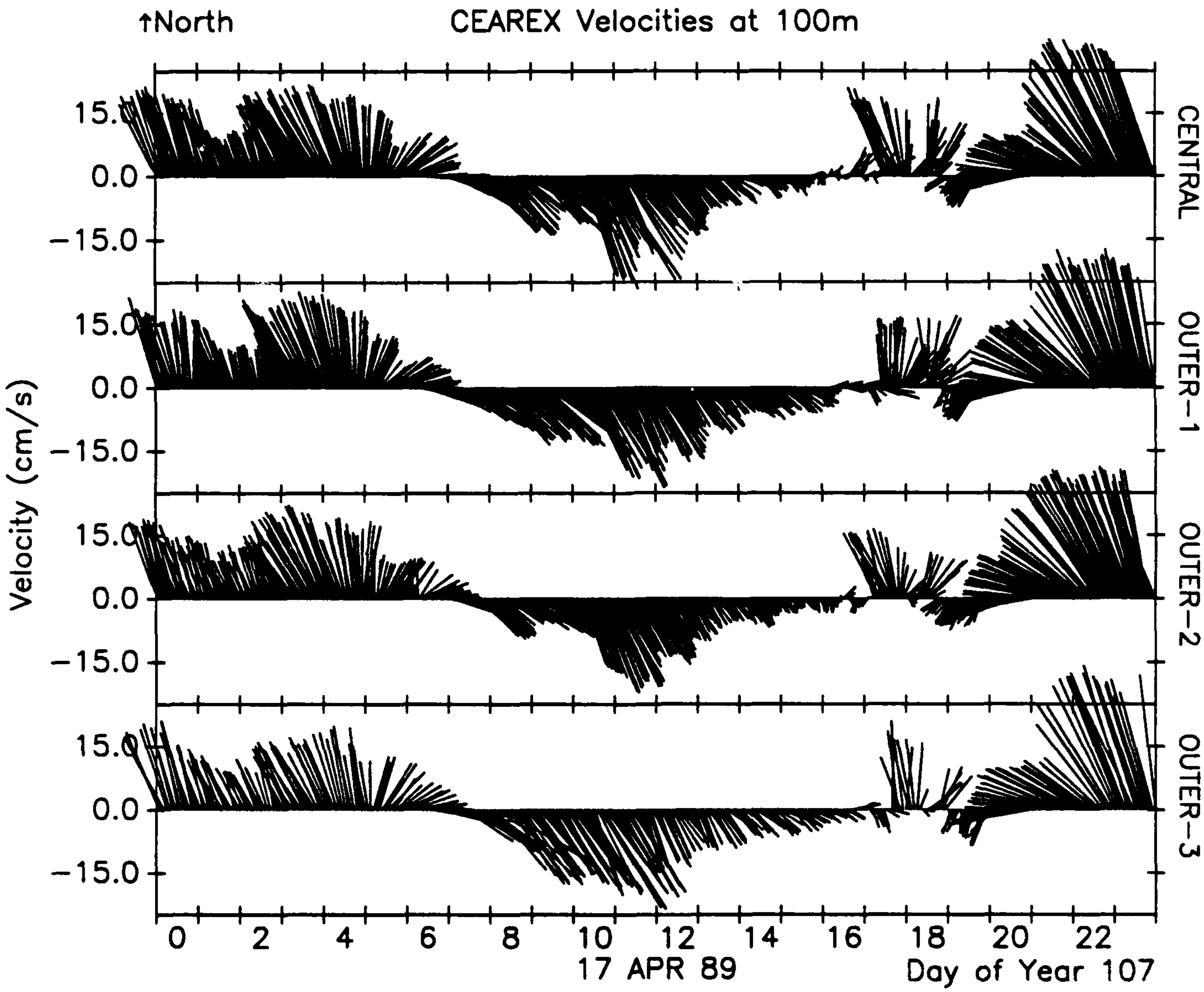

↑North
CEAREX Velocities at 100m
Velocity (cm/s)
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
12 APR 89
Day of Year 102

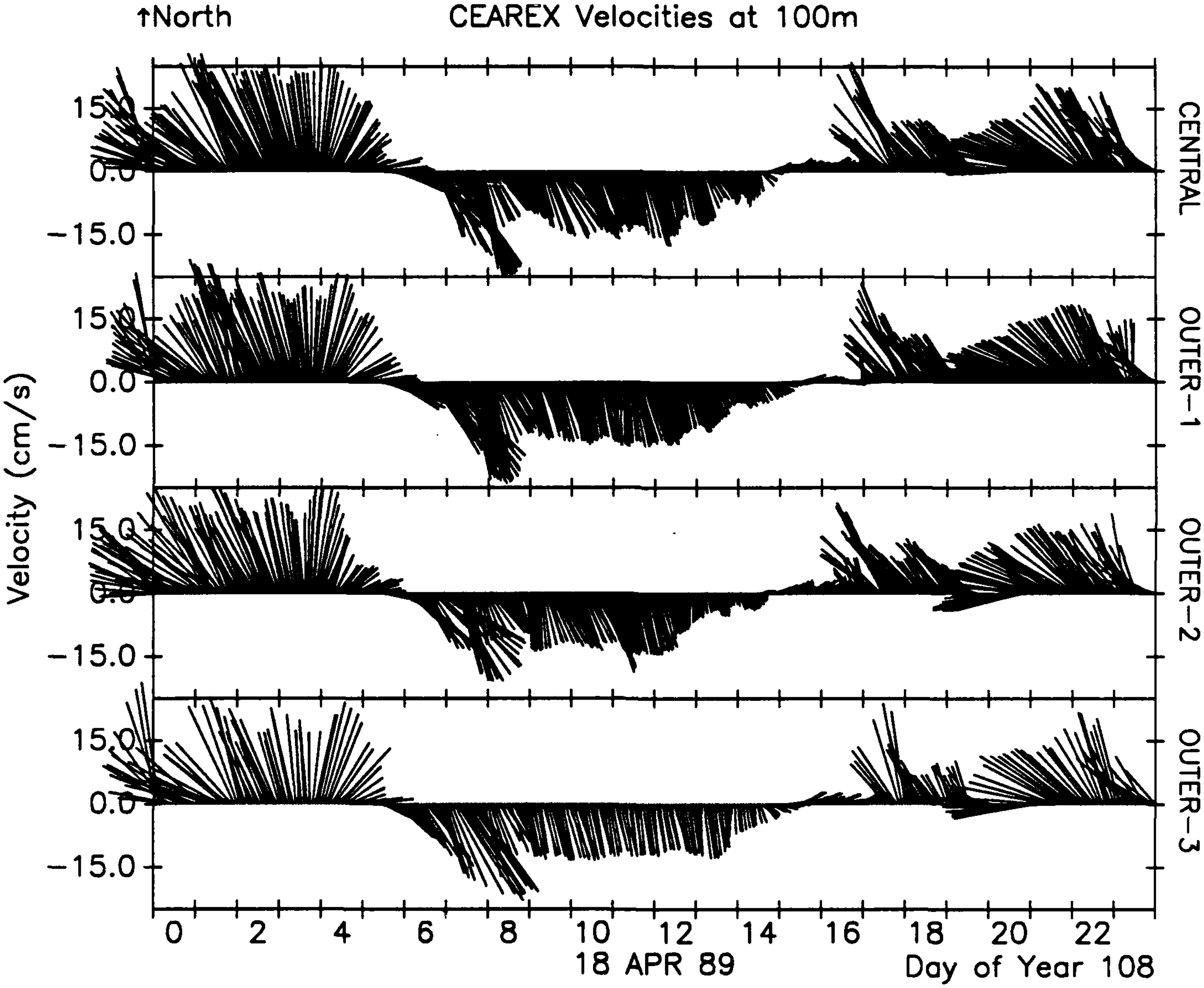

↑North
CEAREX Velocities at 100m
Velocity (cm/s)
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
13 APR 89
Day of Year 103

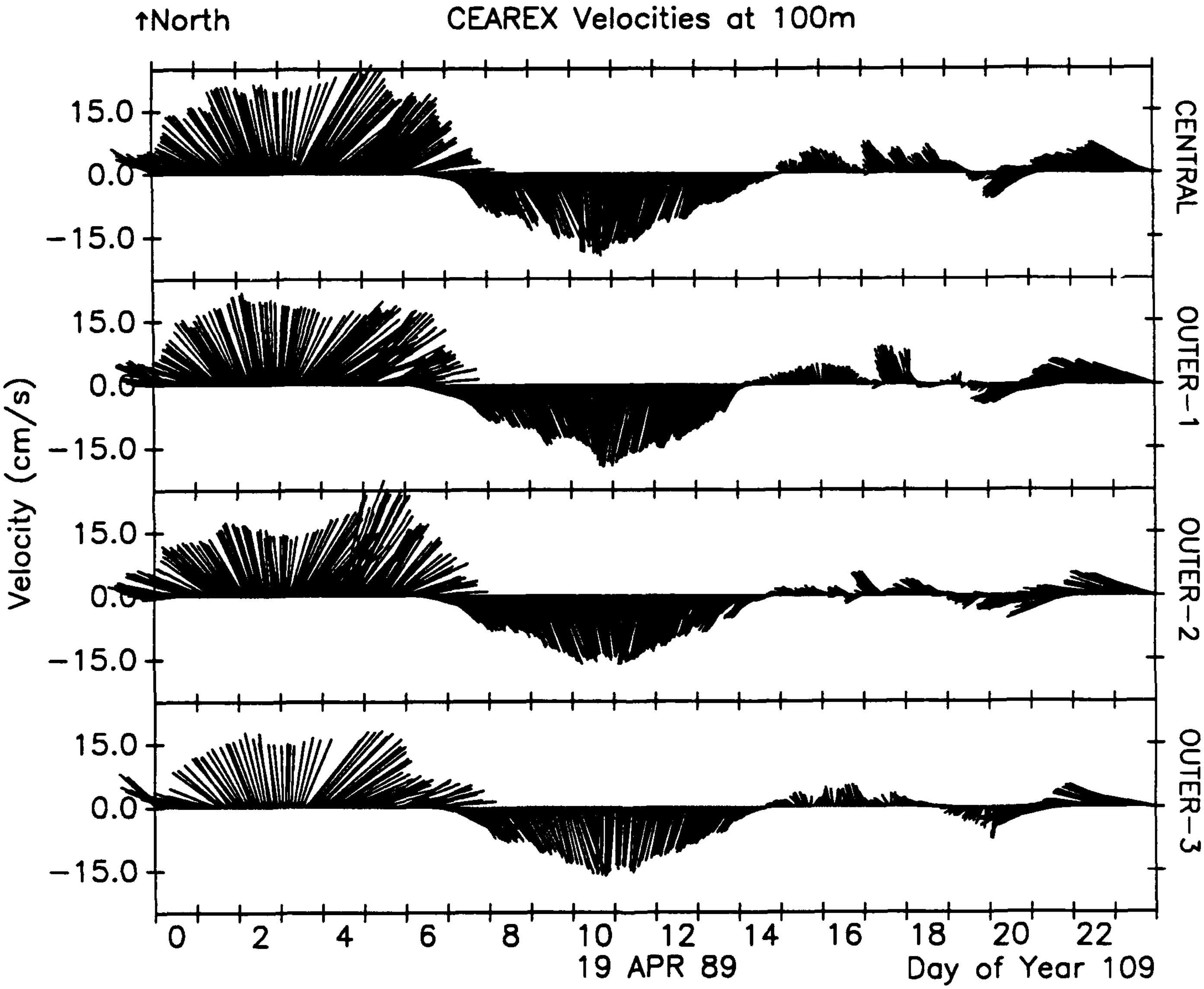

↑North
CEAREX Velocities at 100m
Velocity (cm/s)
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
14 APR 89
Day of Year 104

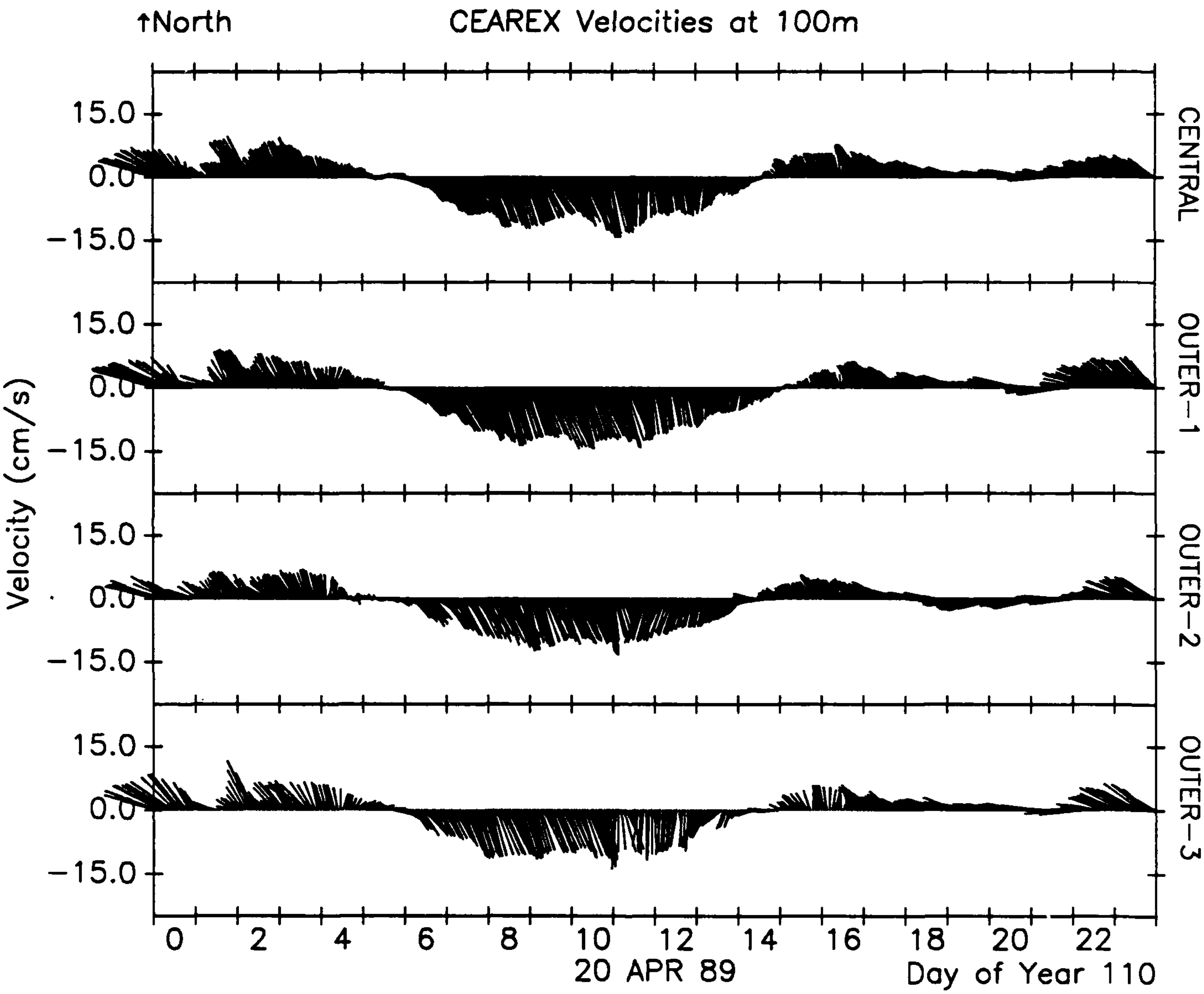

↑North
CEAREX Velocities at 100m
Velocity (cm/s)
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
15 APR 89
Day of Year 105

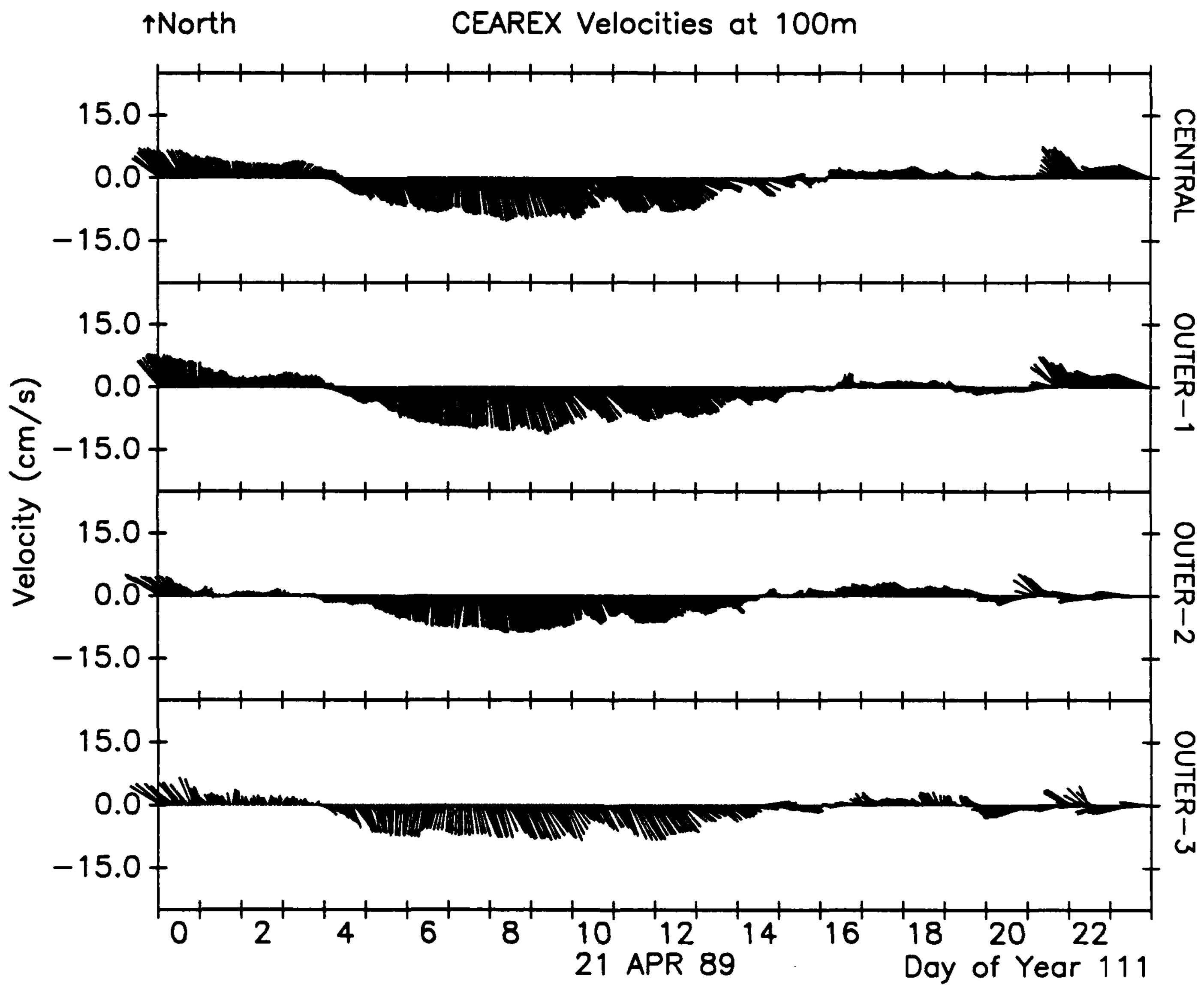

↑North
CEAREX Velocities at 100m
Velocity (cm/s)
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
16 APR 89
Day of Year 106

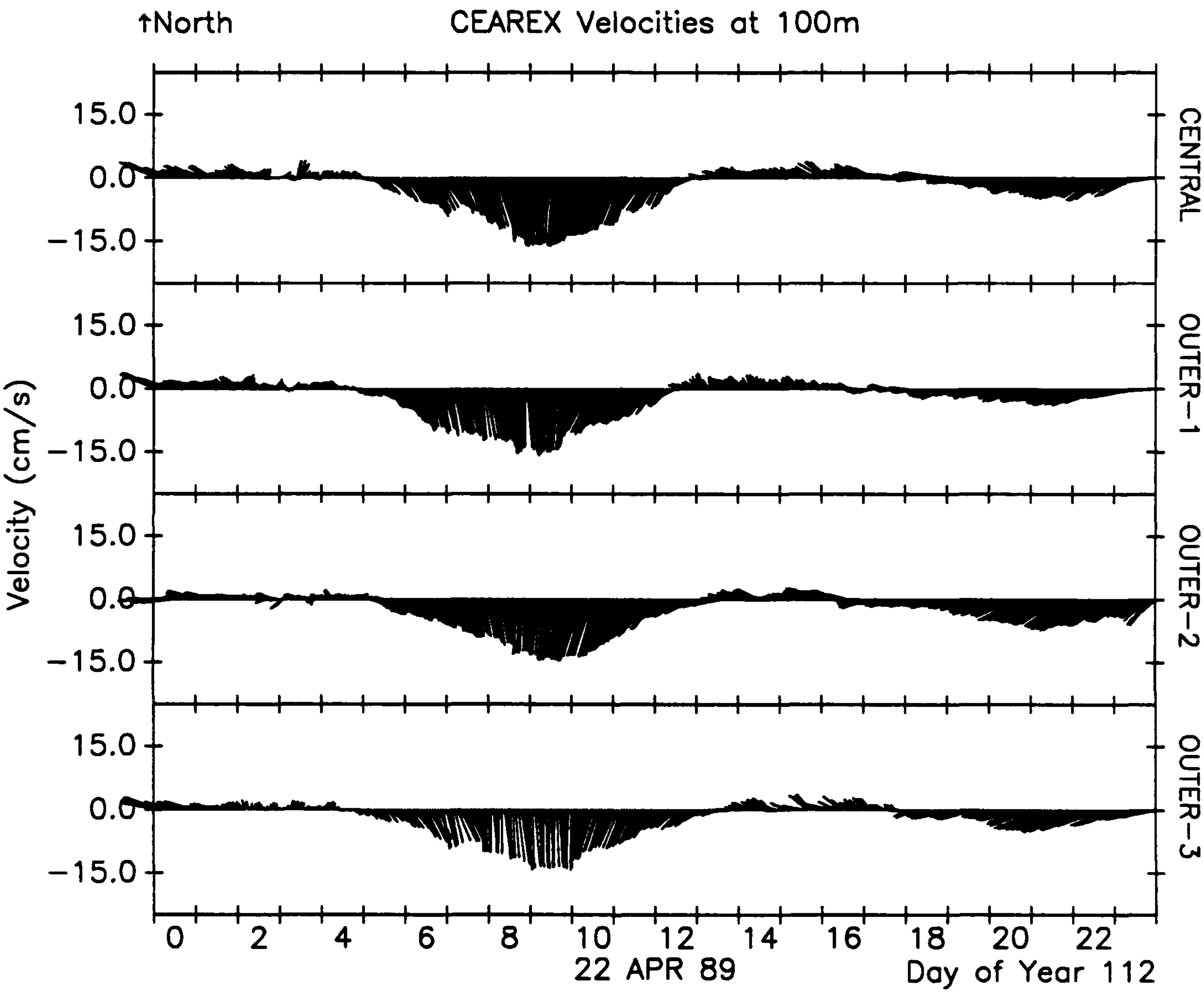

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
17 APR 89
Day of Year 107

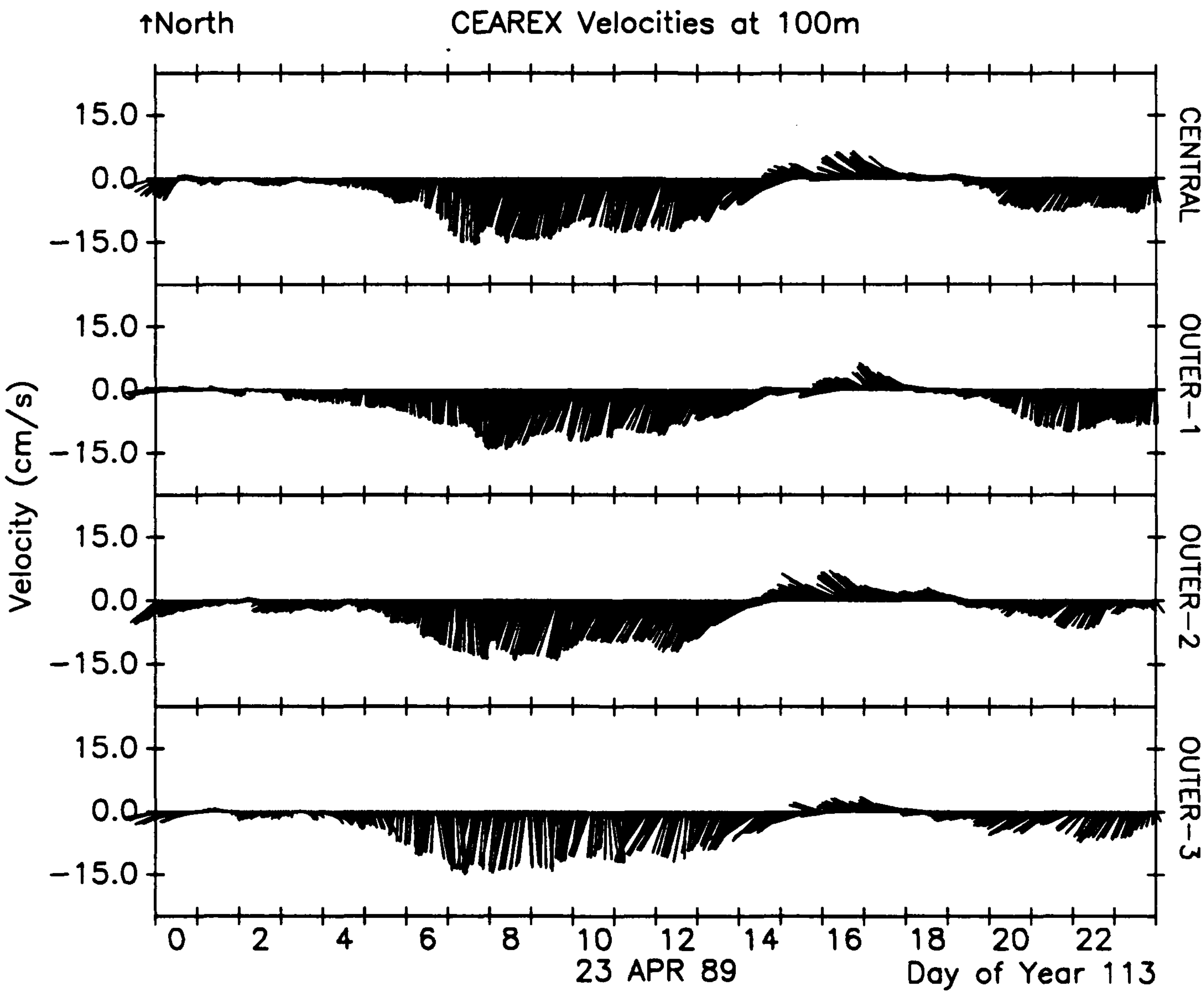

↑North
CEAREX Velocities at 100m
Velocity (cm/s)
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
18 APR 89
Day of Year 108

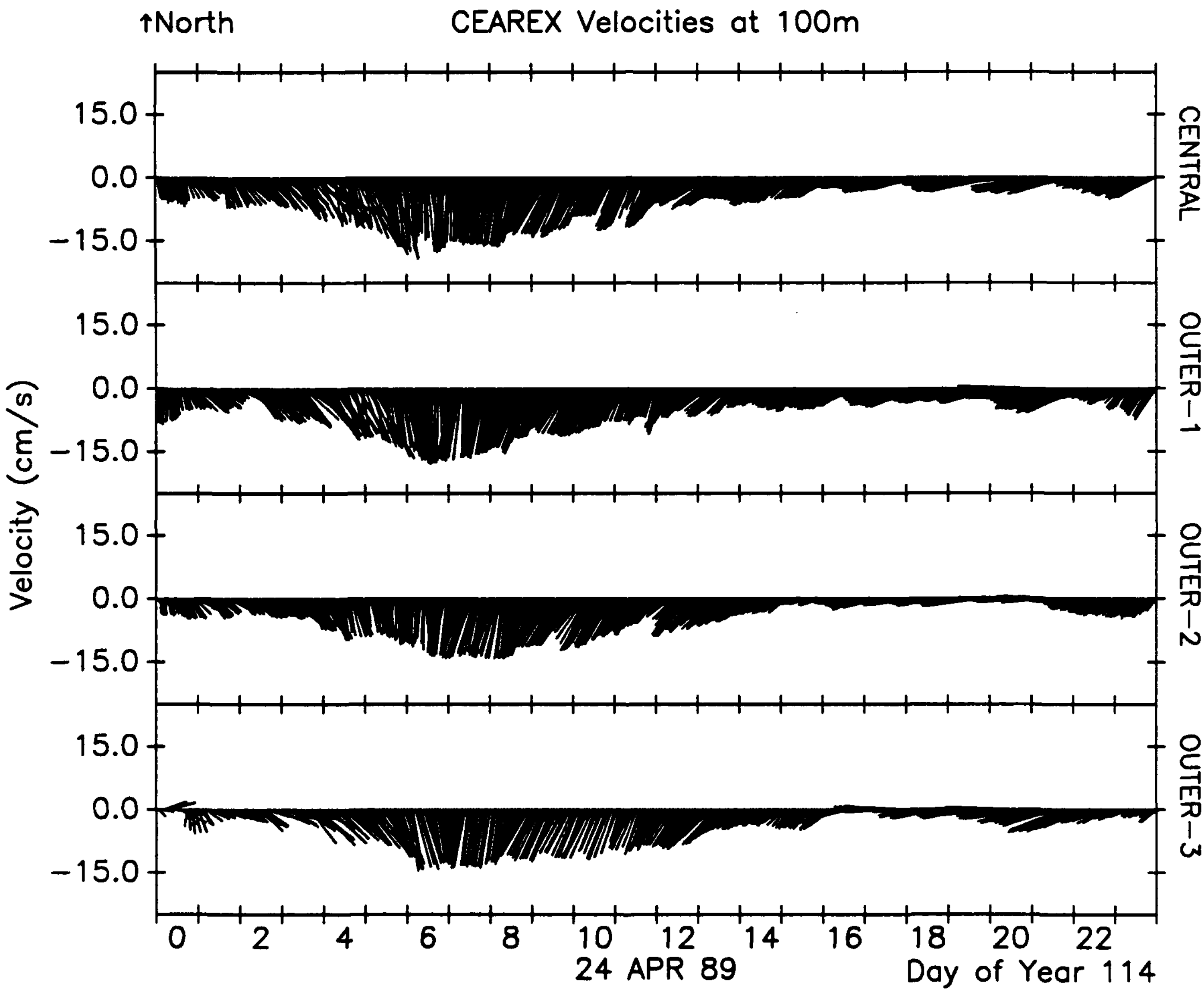

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
19 APR 89
Day of Year 109

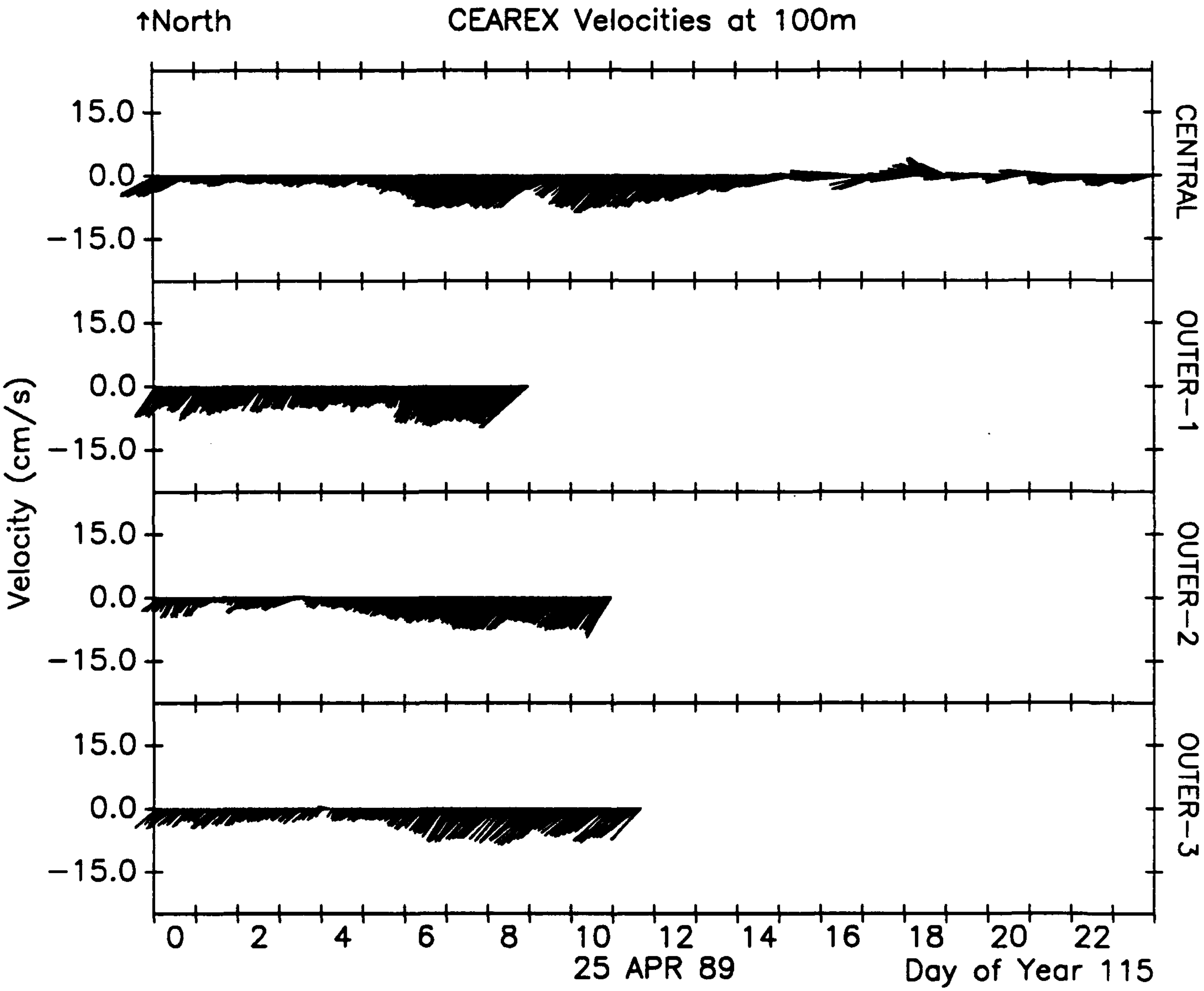

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
20 APR 89
Day of Year 110

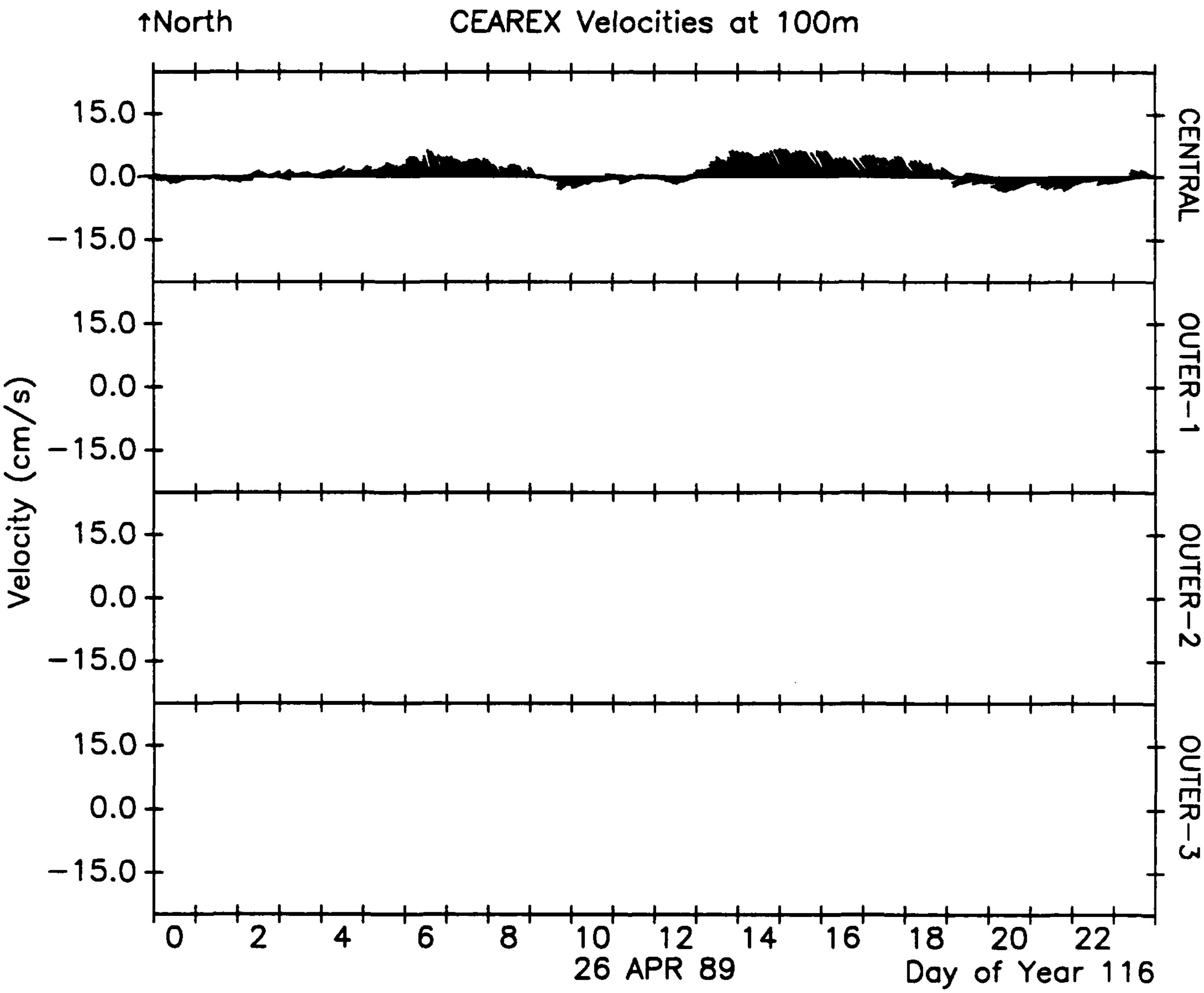

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
21 APR 89
Day of Year 111

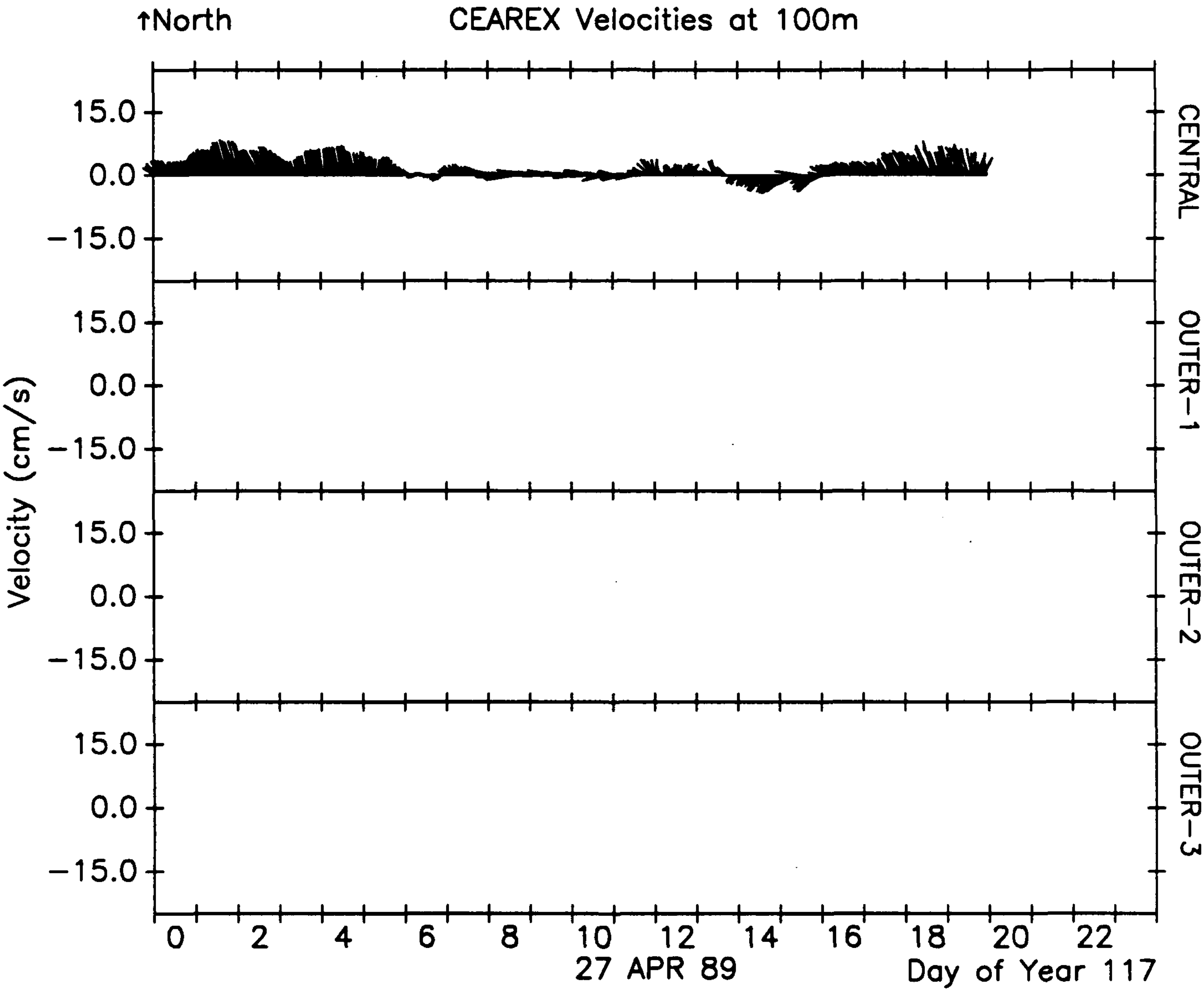

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0 2 4 6 8 10 12 14 16 18 20 22
22 APR 89
Day of Year 112


↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
Velocity (cm/s)
CENTRAL
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
23 APR 89
Day of Year 113


↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
24 APR 89
Day of Year 114

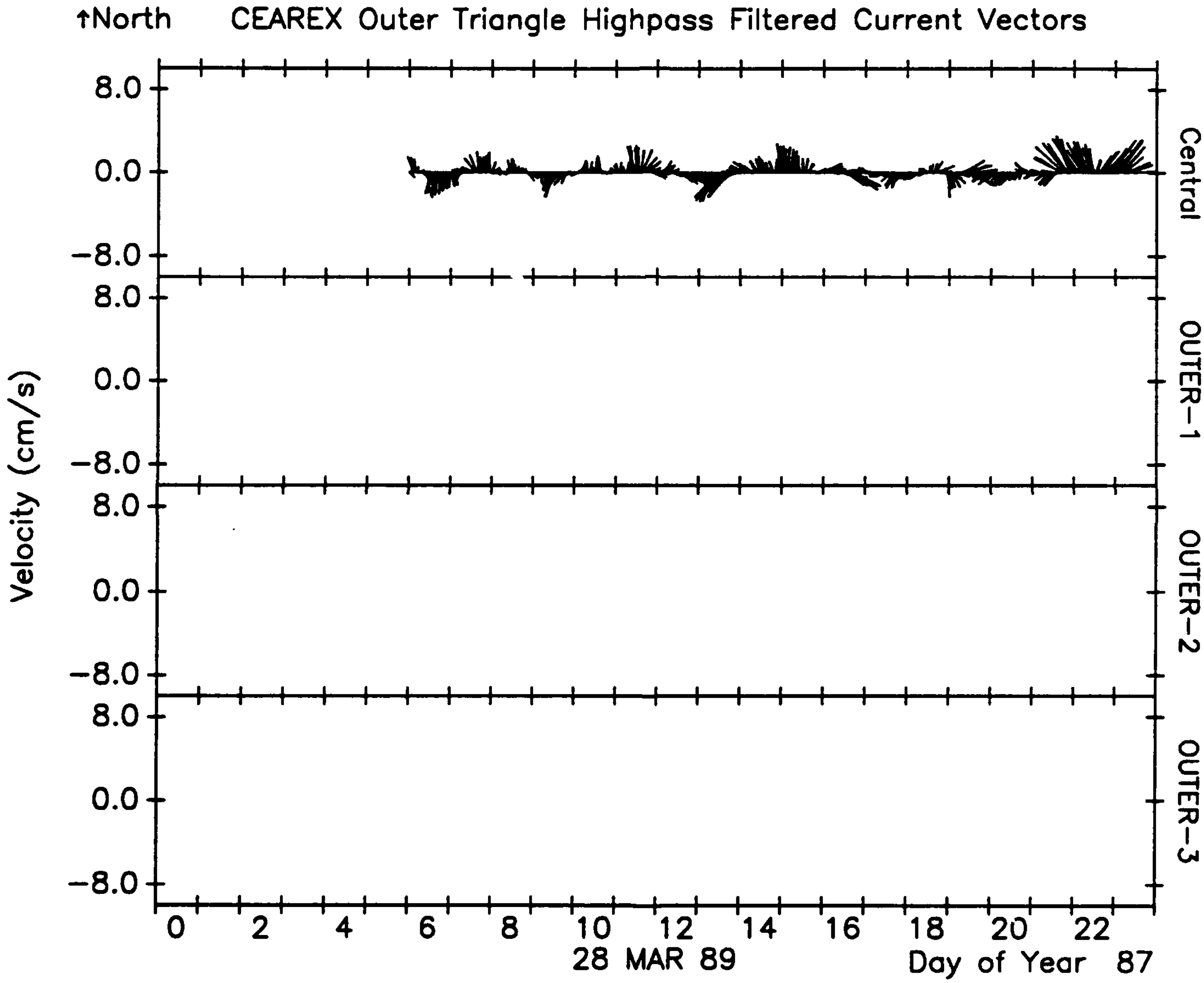

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
25 APR 89
Day of Year 115

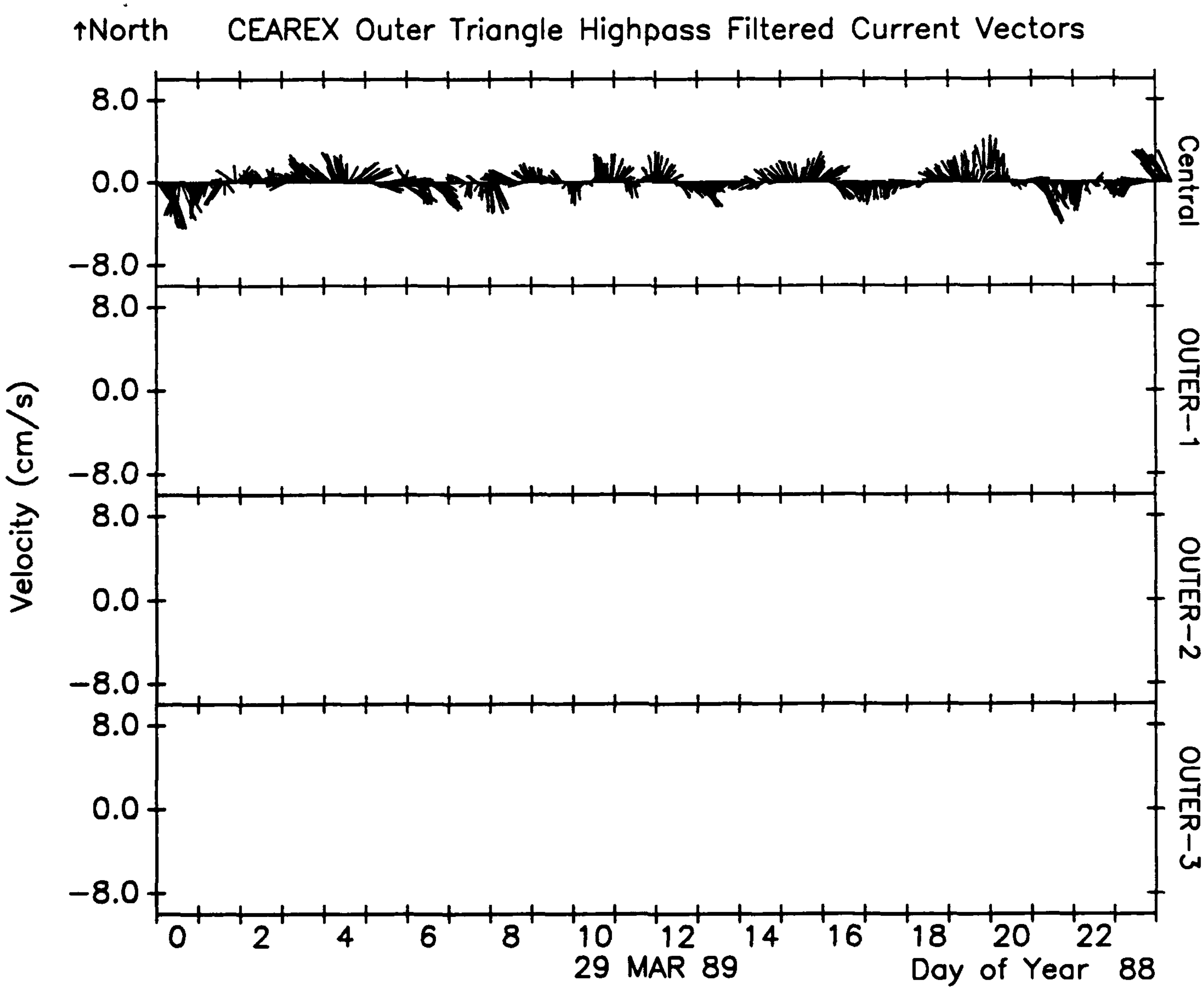

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
26 APR 89
Day of Year 116

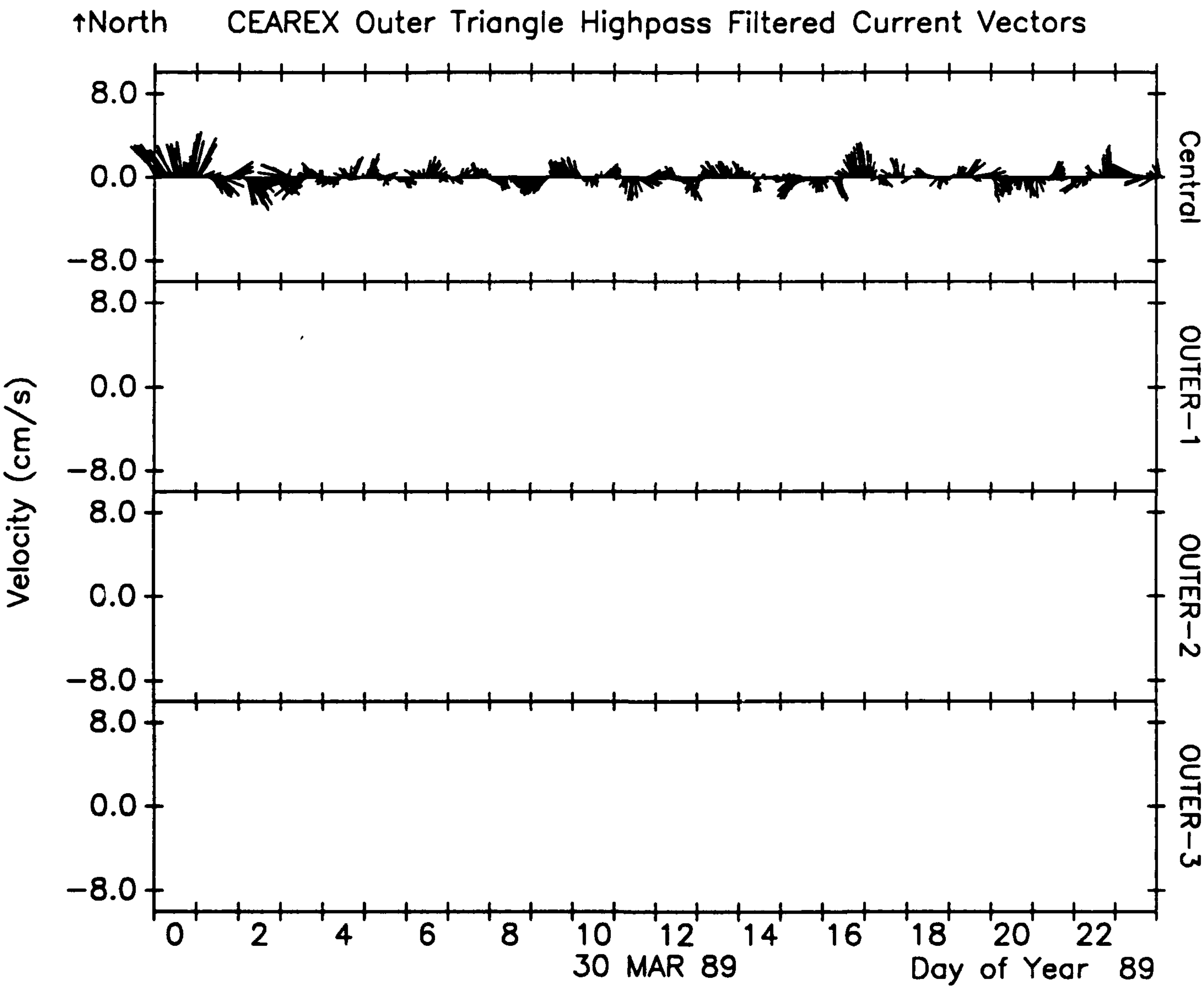

↑North
CEAREX Velocities at 100m
15.0
0.0
−15.0
CENTRAL
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0 2 4 6 8 10 12 14 16 18 20 22
27 APR 89
Day of Year 117

TIME SERIES OF VELOCITY AT 100 m: HIGH-PASS FILTERED

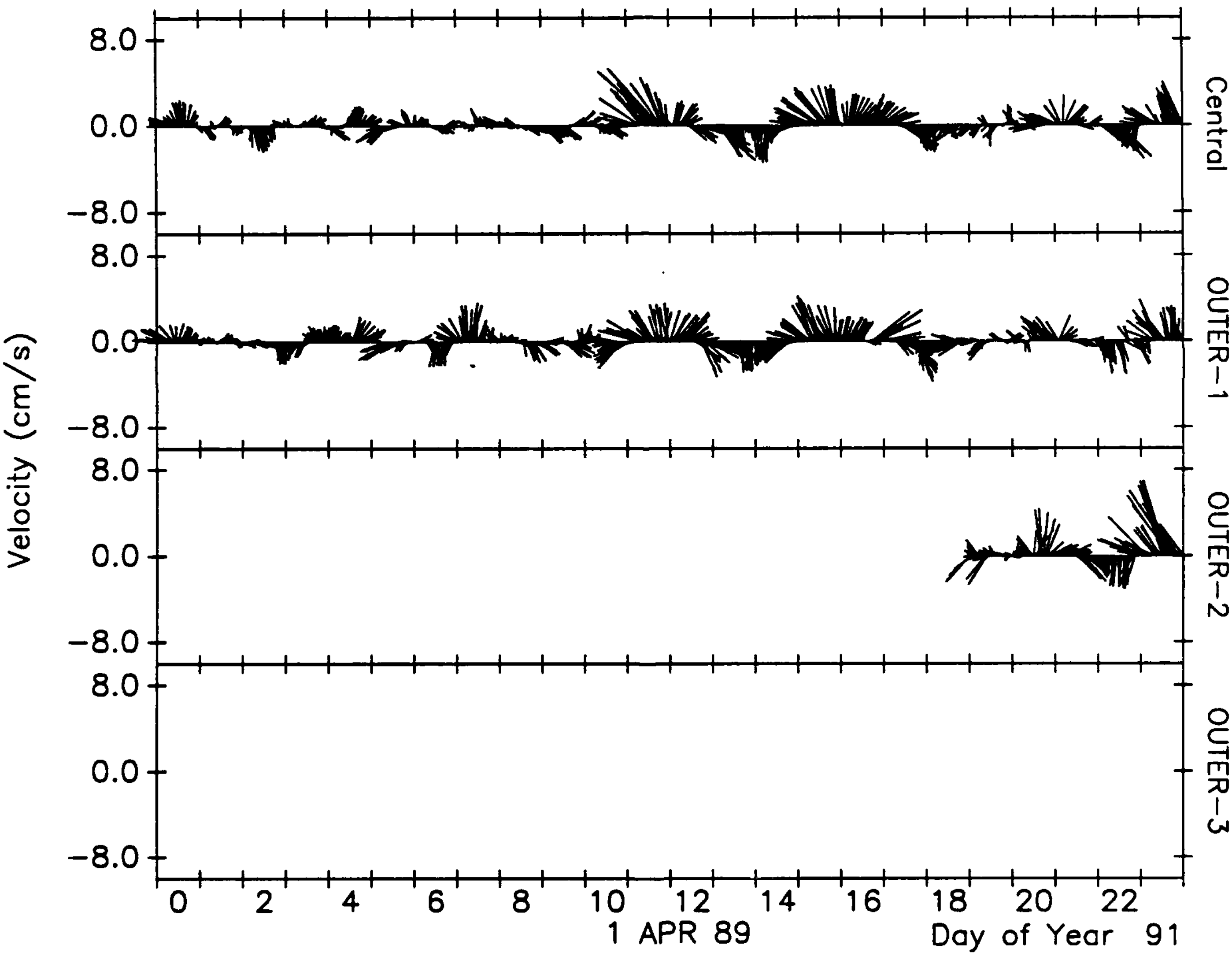
On the following 31 pages are observations of velocity at 100 m depth from the Central, O1, O2, and O3 moorings. These data were recorded by S-4 current meters; a high-pass filter with a 6 hour cutoff has been applied. Note: absolute velocities are presented after the start of April 4; relative velocities are shown before. (See Tables 1 and 3).

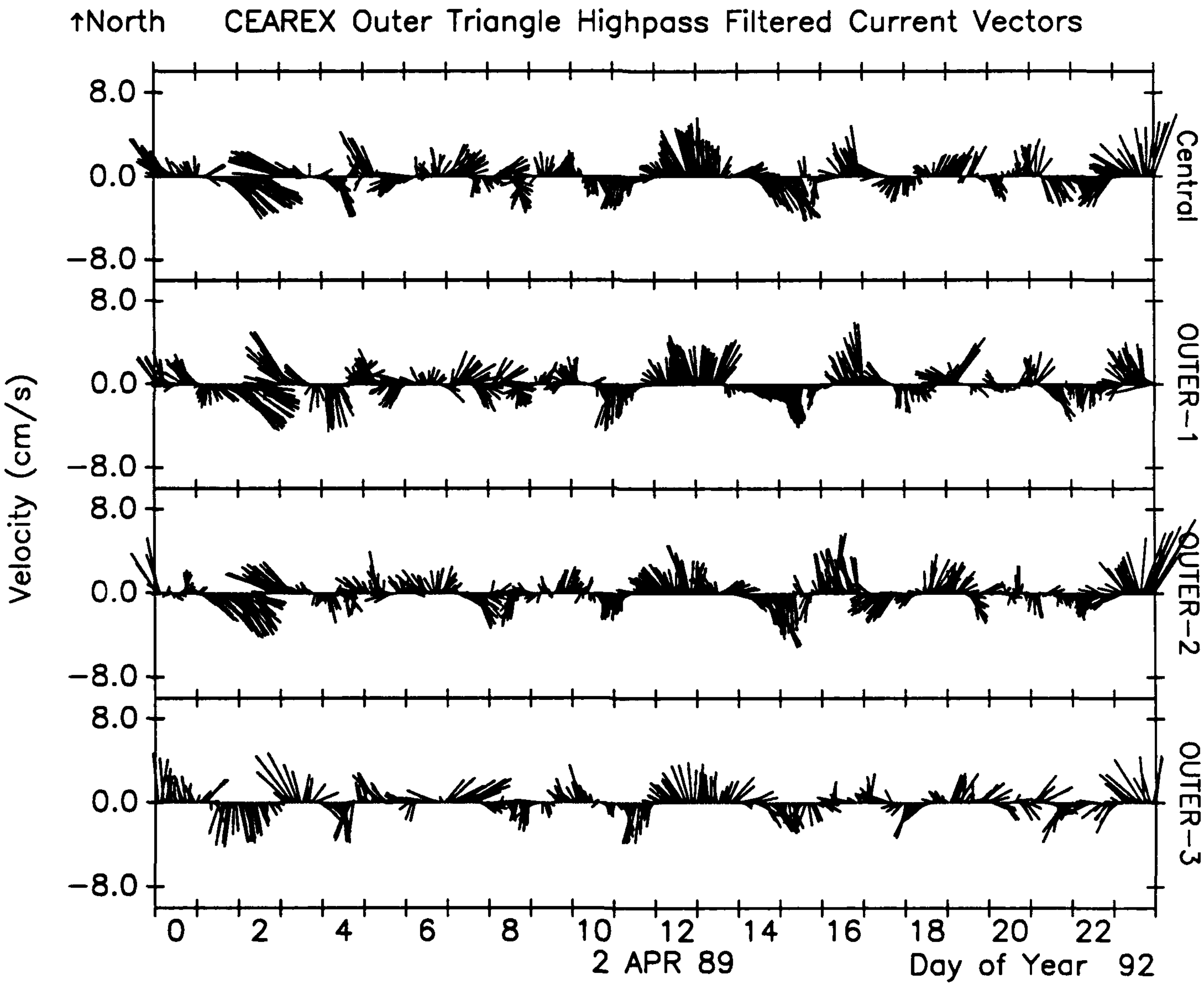

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
28 MAR 89
Day of Year 87

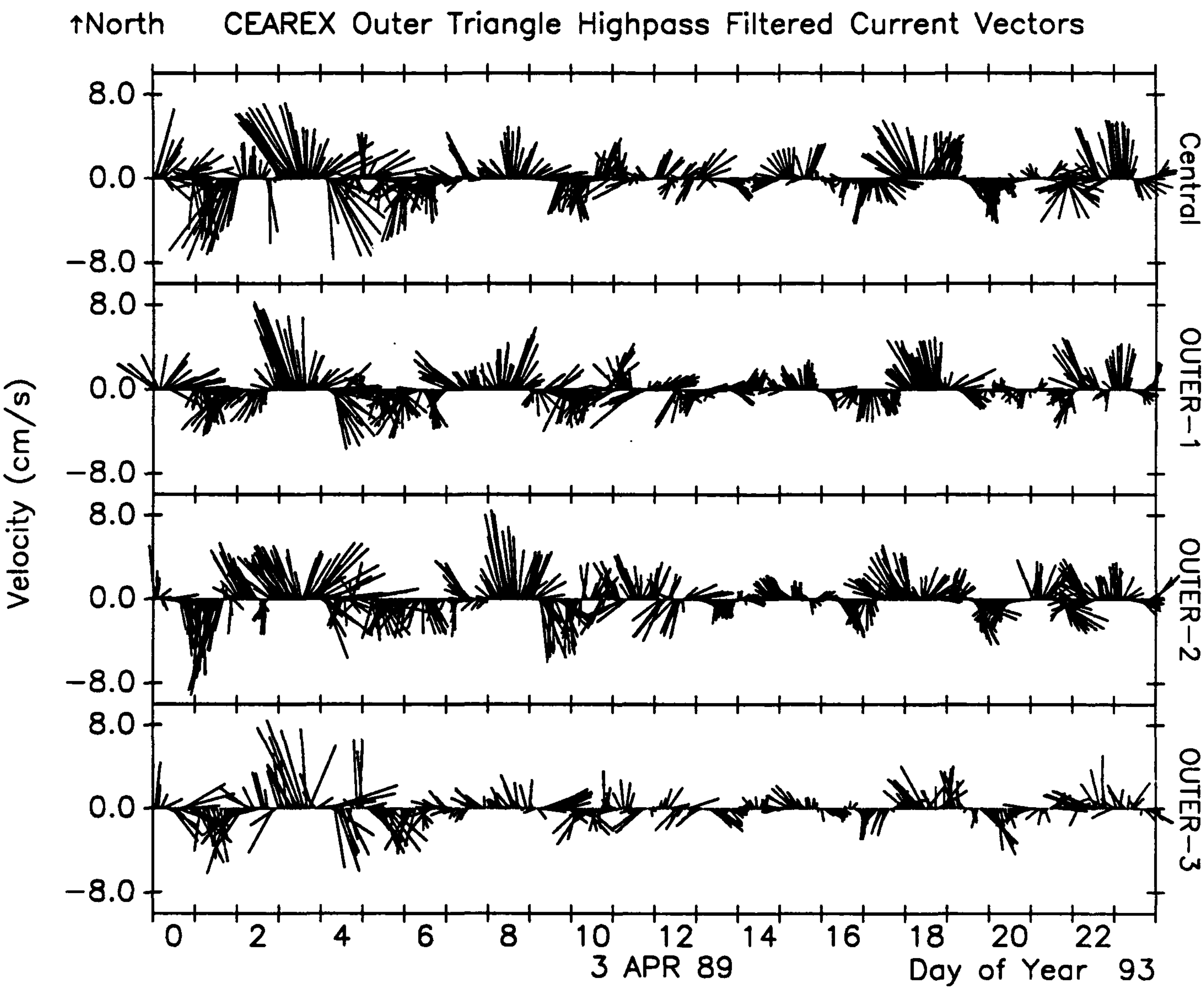

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
−8.0
8.0
0.0
−8.0
8.0
0.0
−8.0
8.0
0.0
−8.0
Velocity (cm/s)
Central
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
29 MAR 89
Day of Year 88

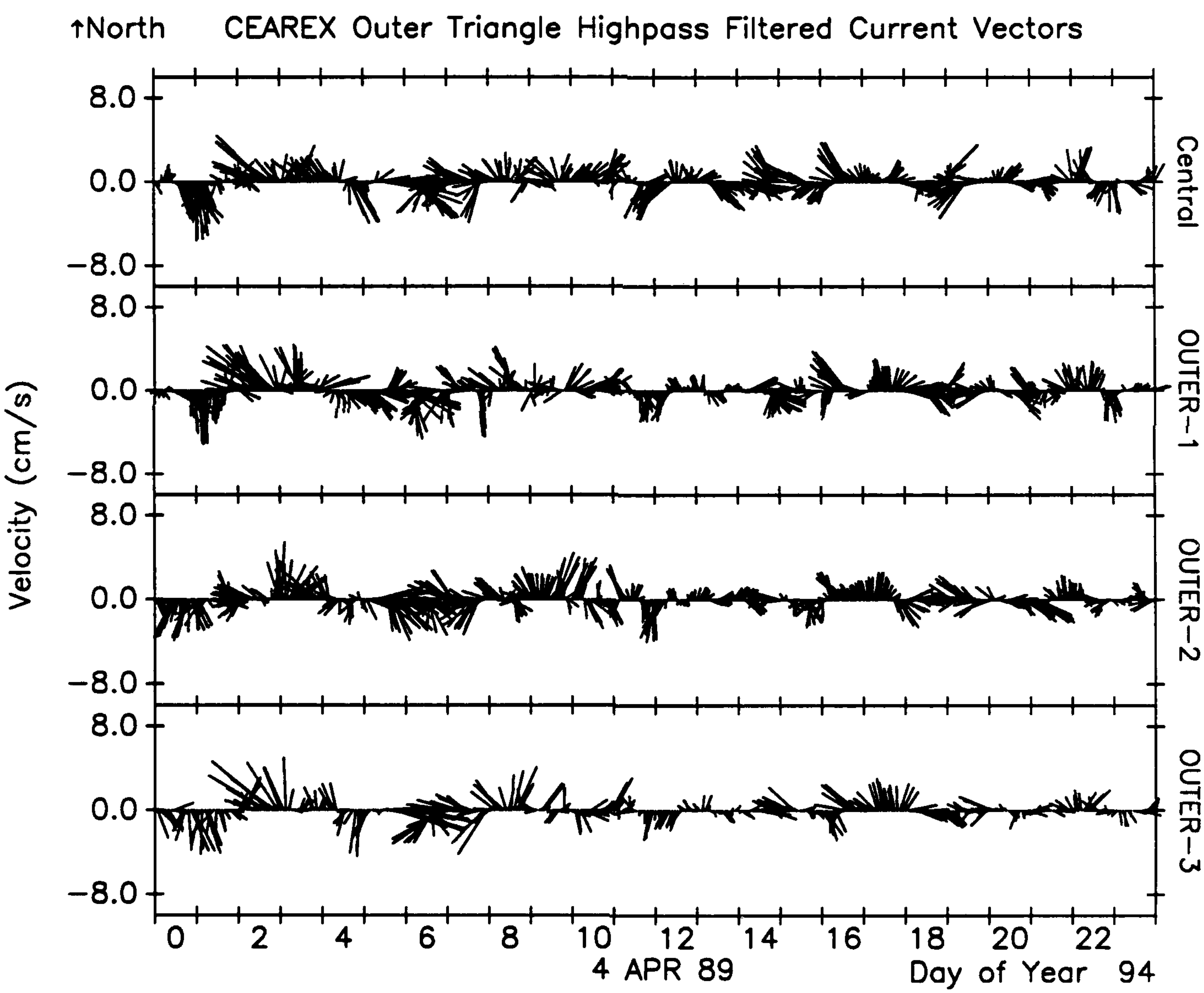

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
30 MAR 89
Day of Year 89

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors

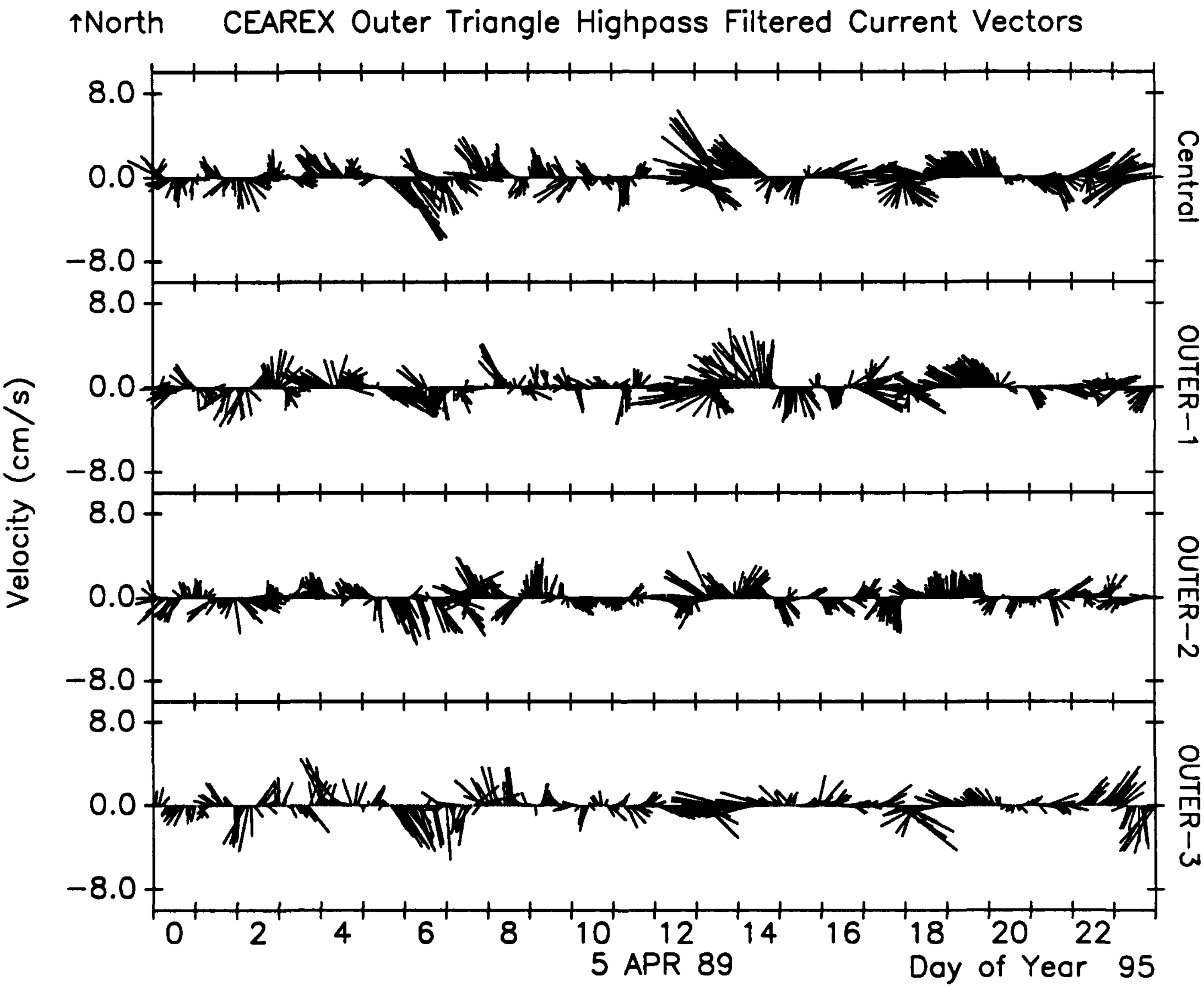


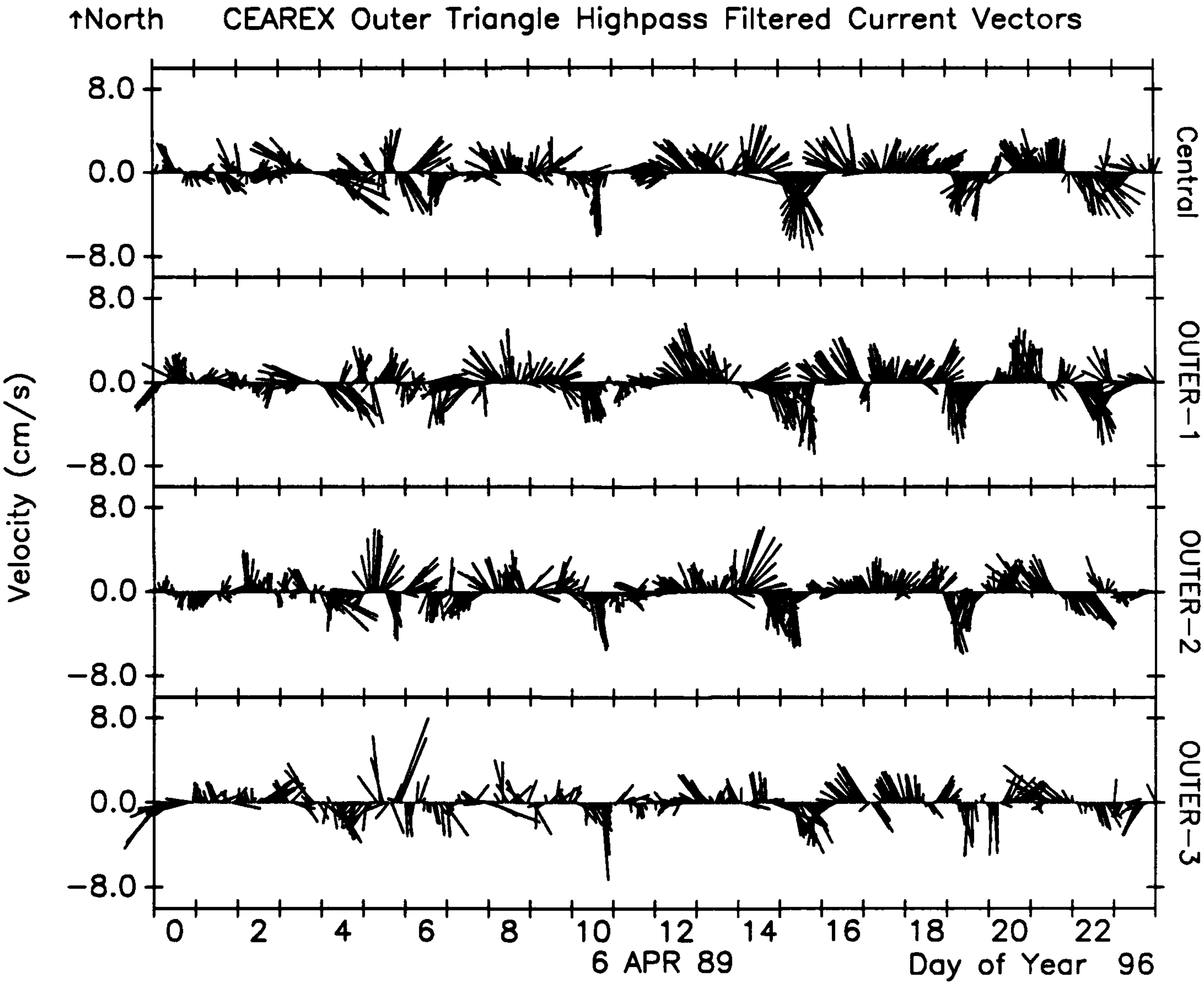

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
2 APR 89
Day of Year 92

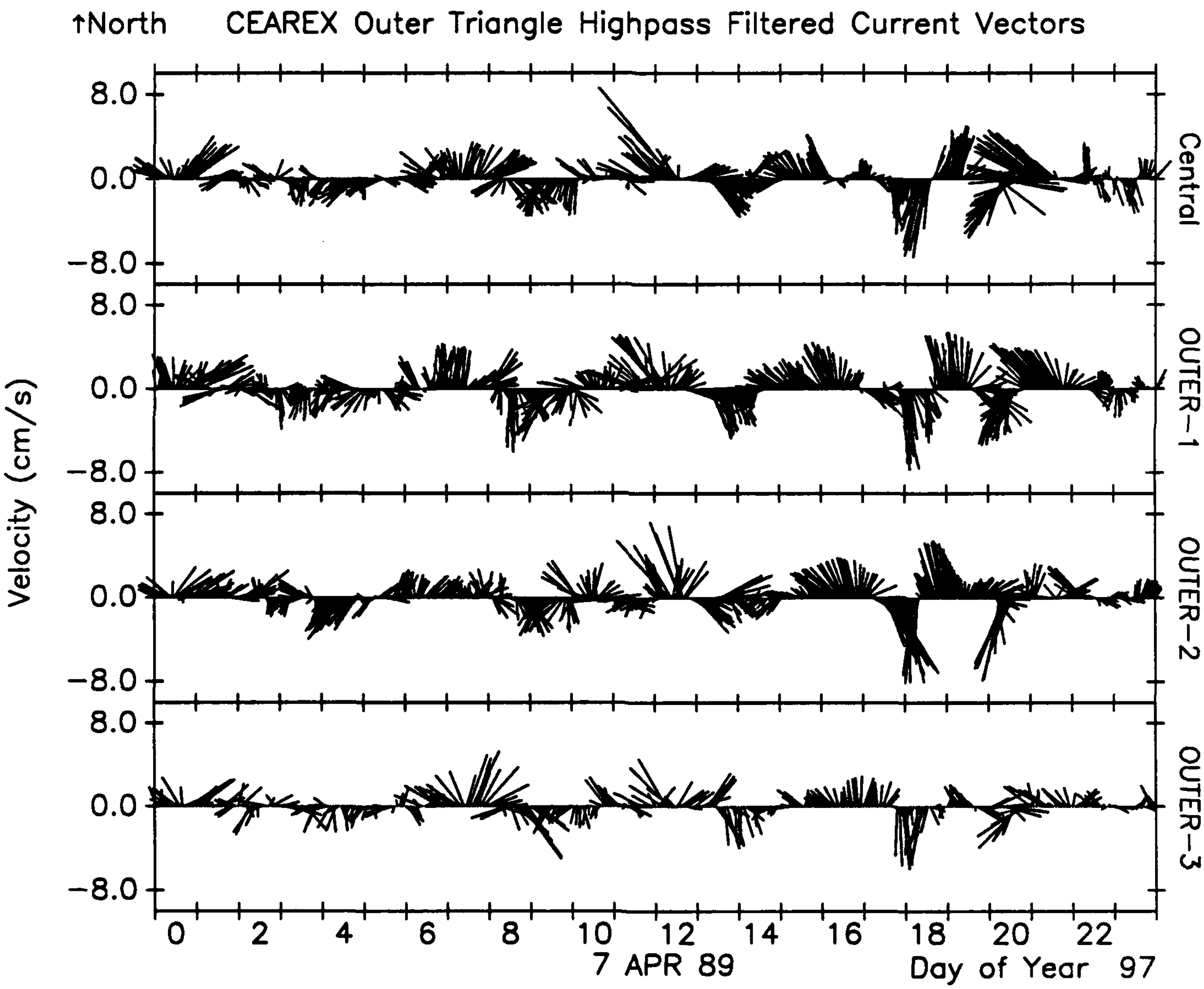

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
-8.0
Central
OUTER-1
OUTER-2
OUTER-3
0 2 4 6 8 10 12 14 16 18 20 22
3 APR 89
Day of Year 93

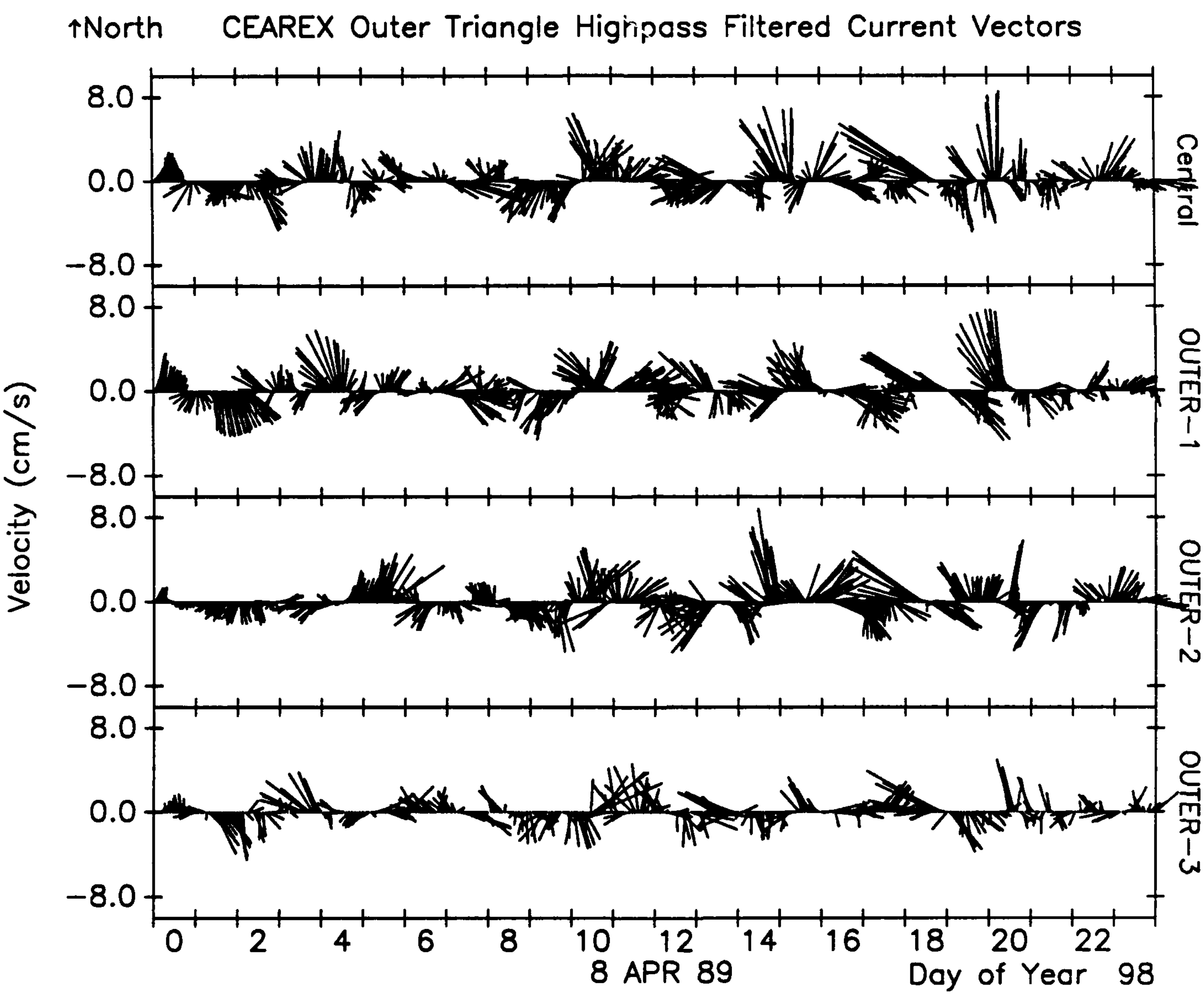


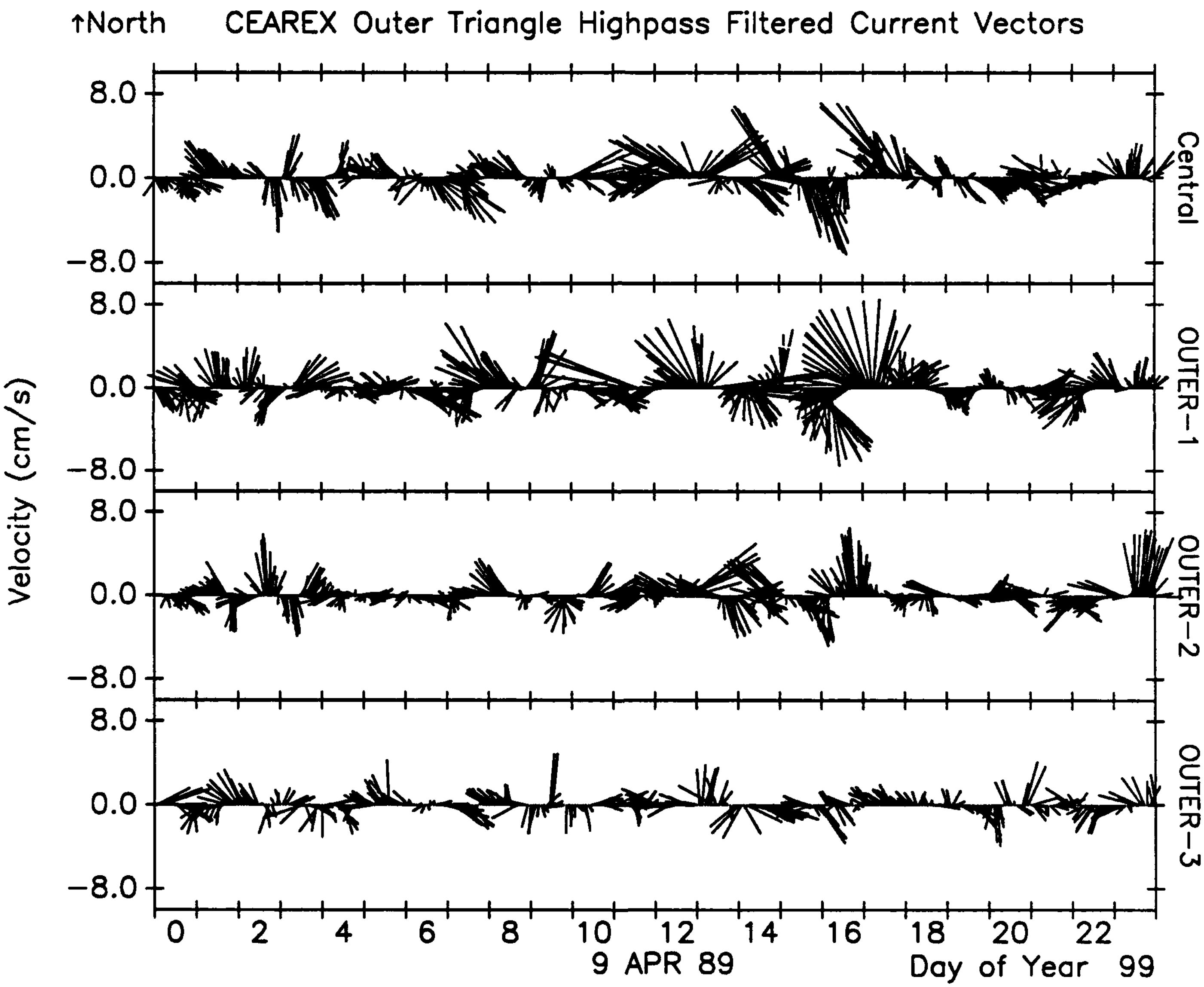
↑North
CEAREX Outer Triangle Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
4 APR 89
Day of Year 94

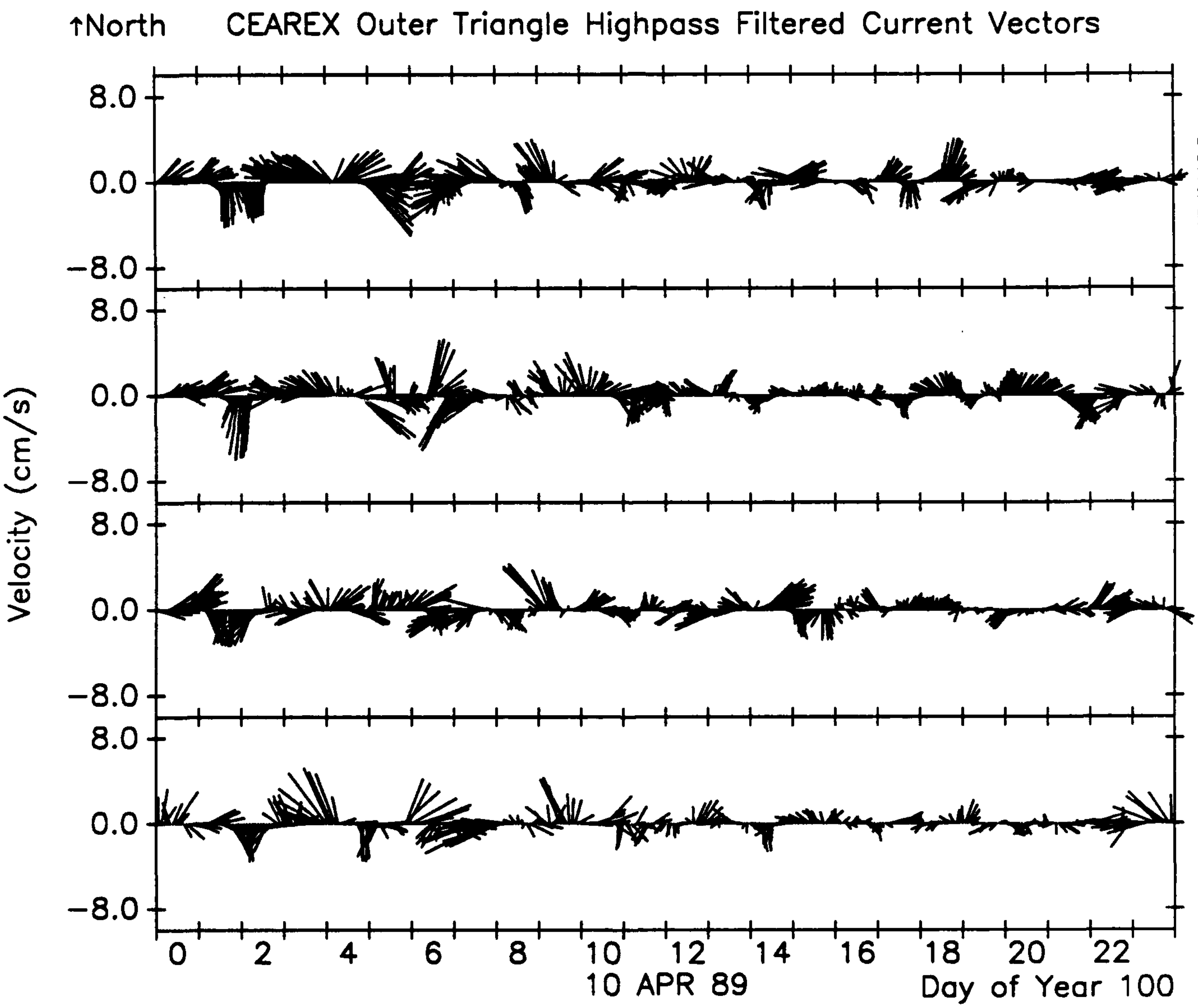

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
5 APR 89
Day of Year 95

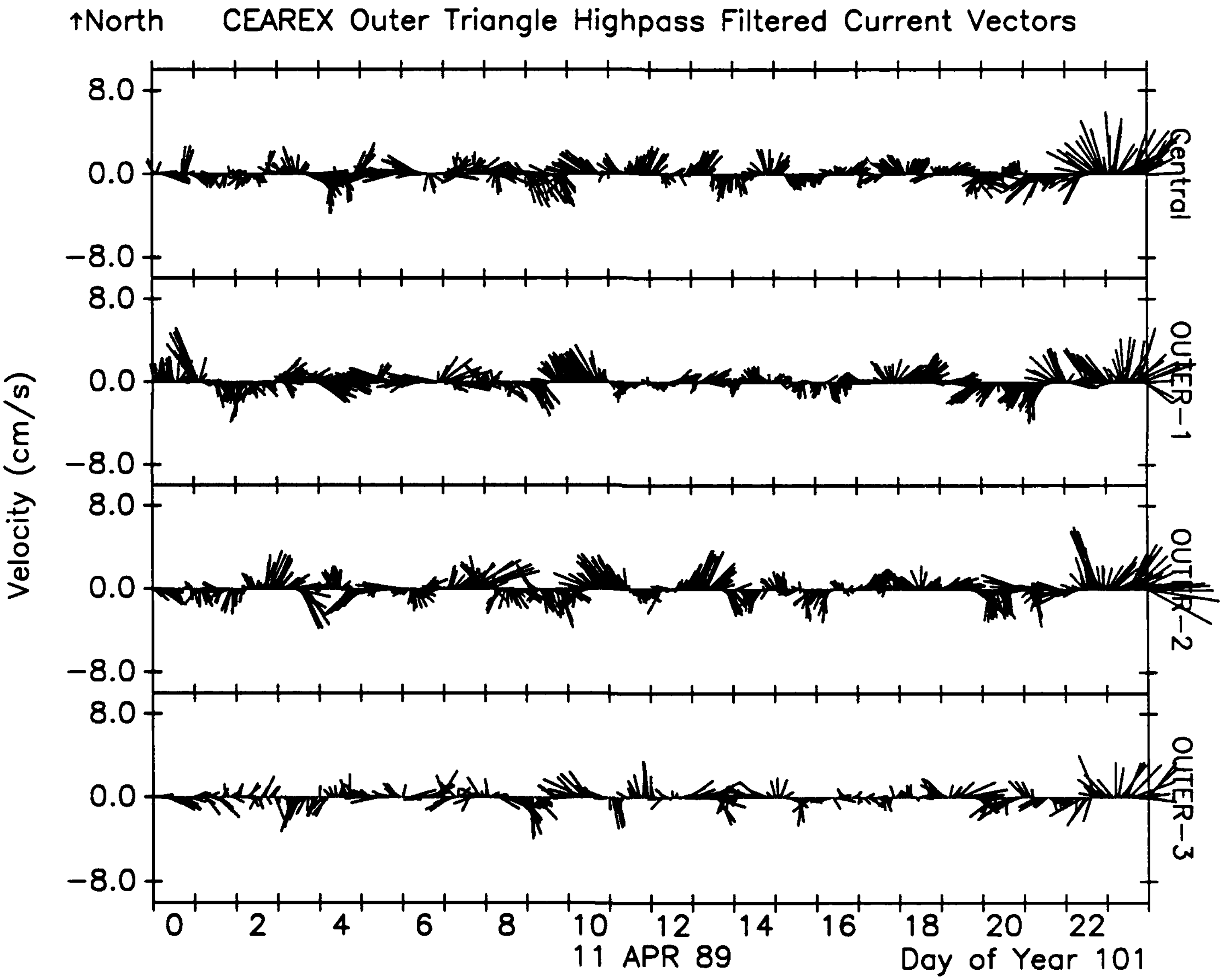

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
−8.0
Central
8.0
0.0
−8.0
OUTER−1
8.0
0.0
−8.0
OUTER−2
8.0
0.0
−8.0
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
6 APR 89
Day of Year 96

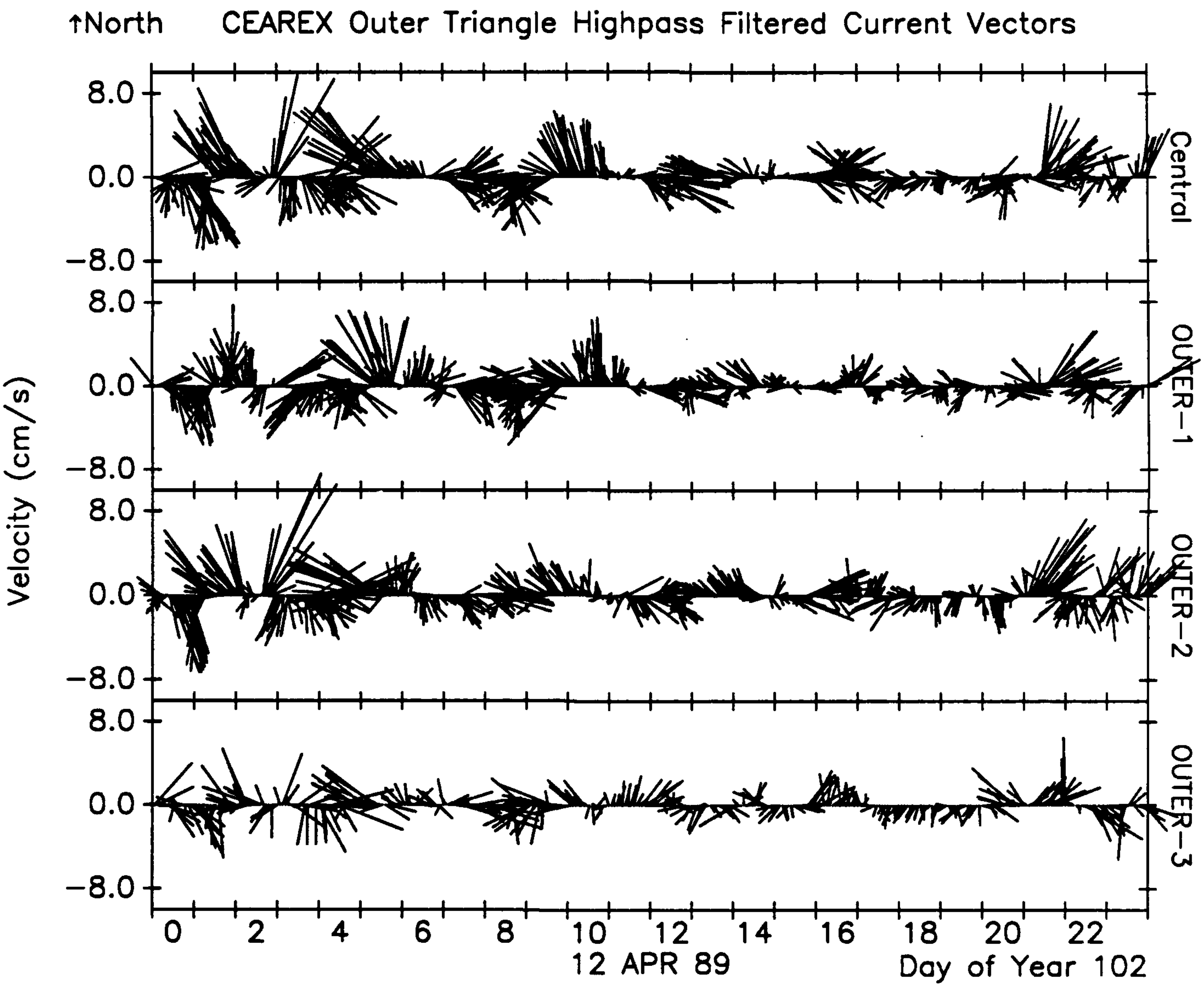

↑North
CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
7 APR 89
Day of Year 97

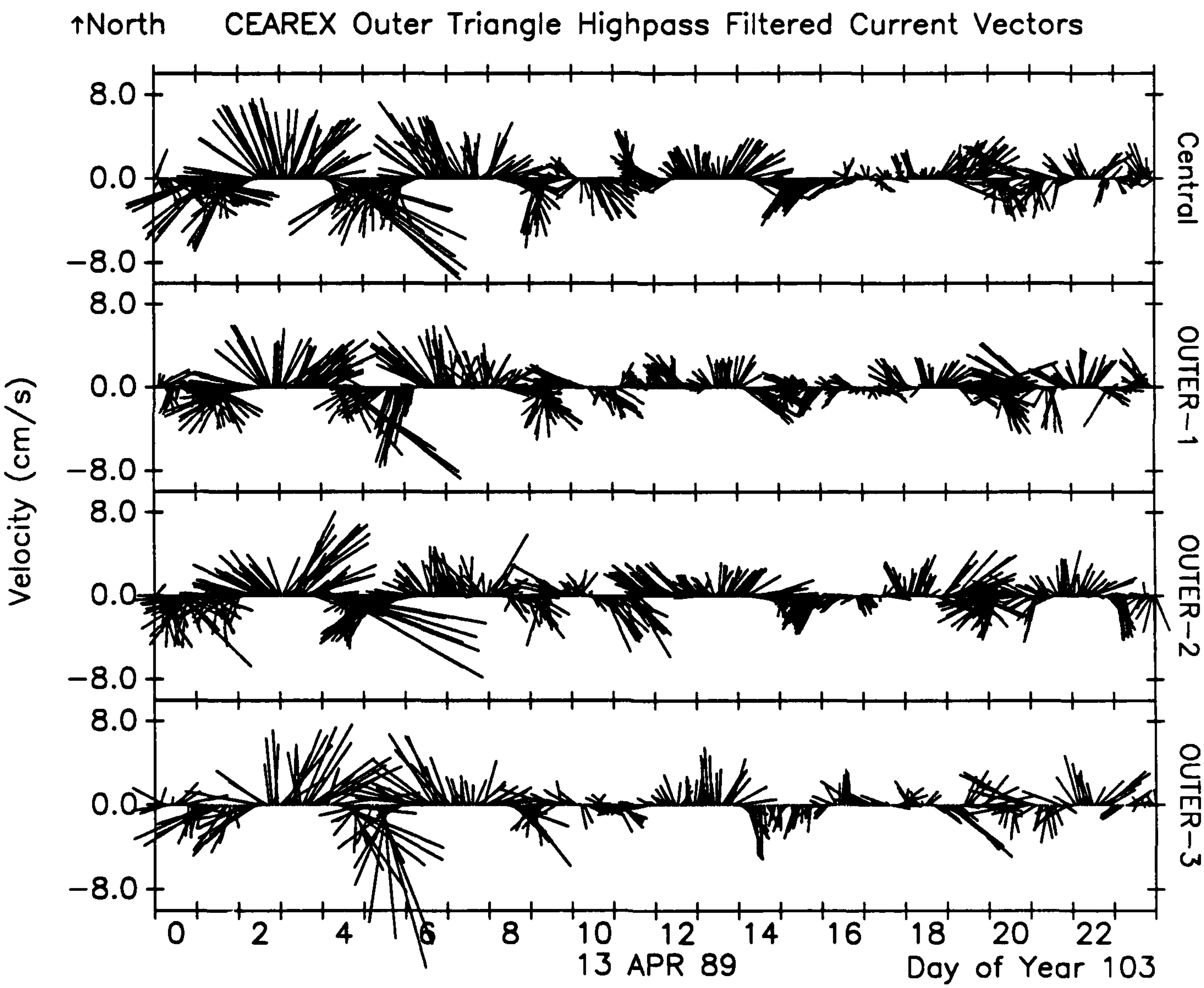

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
0 2 4 6 8 10 12 14 16 18 20 22
8 APR 89
Day of Year 98

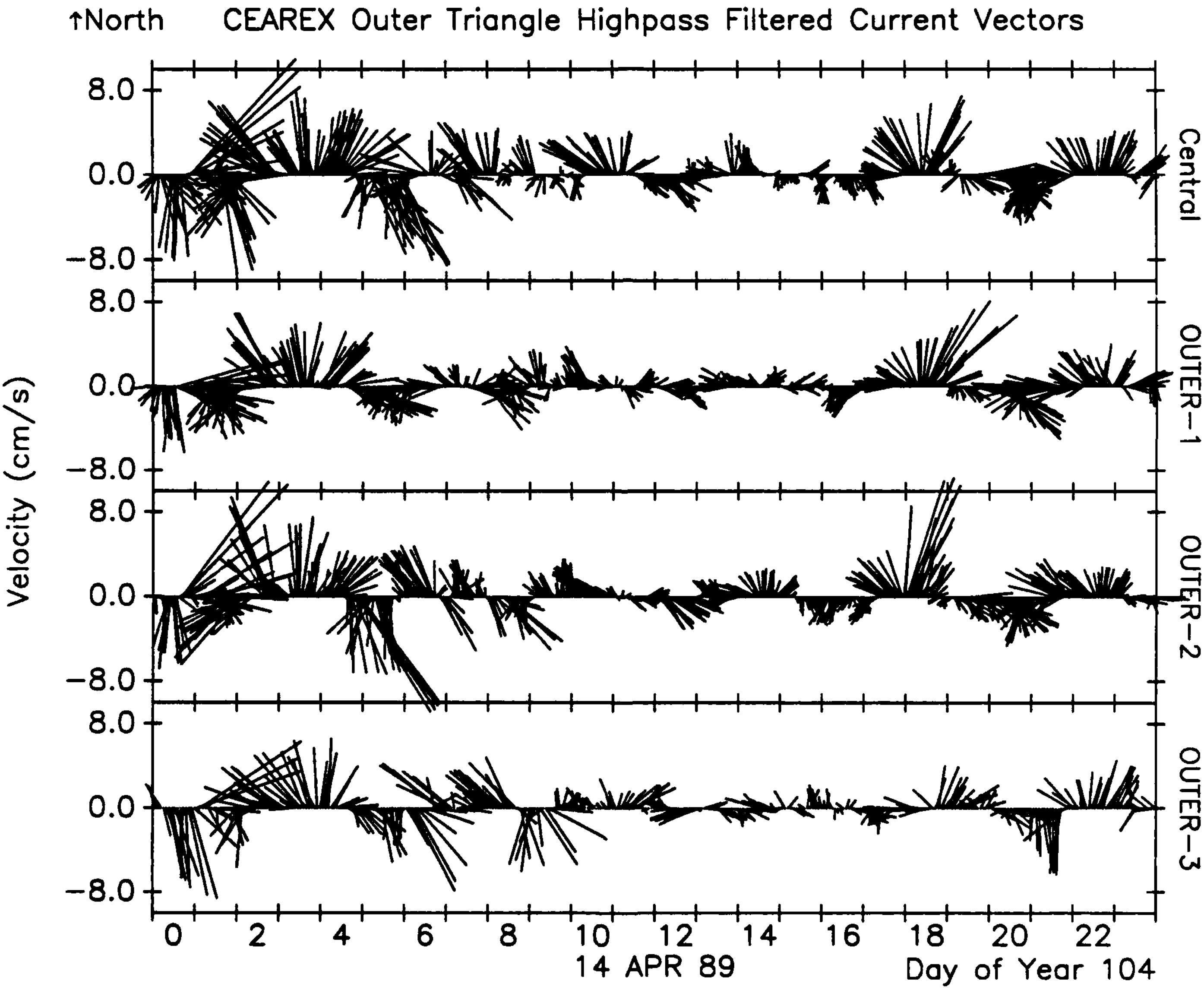

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
0 2 4 6 8 10 12 14 16 18 20 22
9 APR 89
Day of Year 99

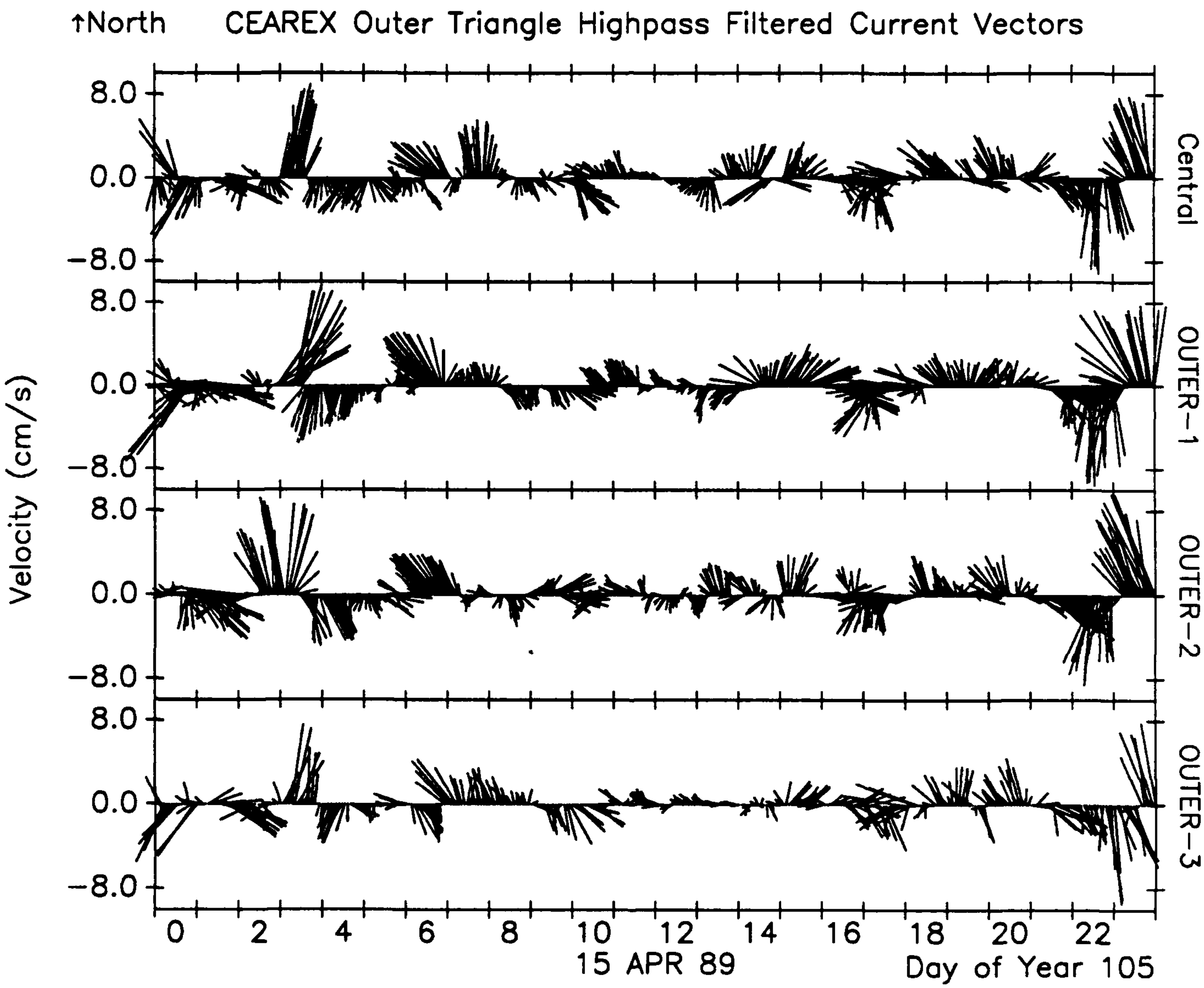

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
−8.0
Central
8.0
0.0
−8.0
OUTER−1
8.0
0.0
−8.0
OUTER−2
8.0
0.0
−8.0
OUTER−3
Velocity (cm/s)
0 2 4 6 8 10 12 14 16 18 20 22
10 APR 89
Day of Year 100

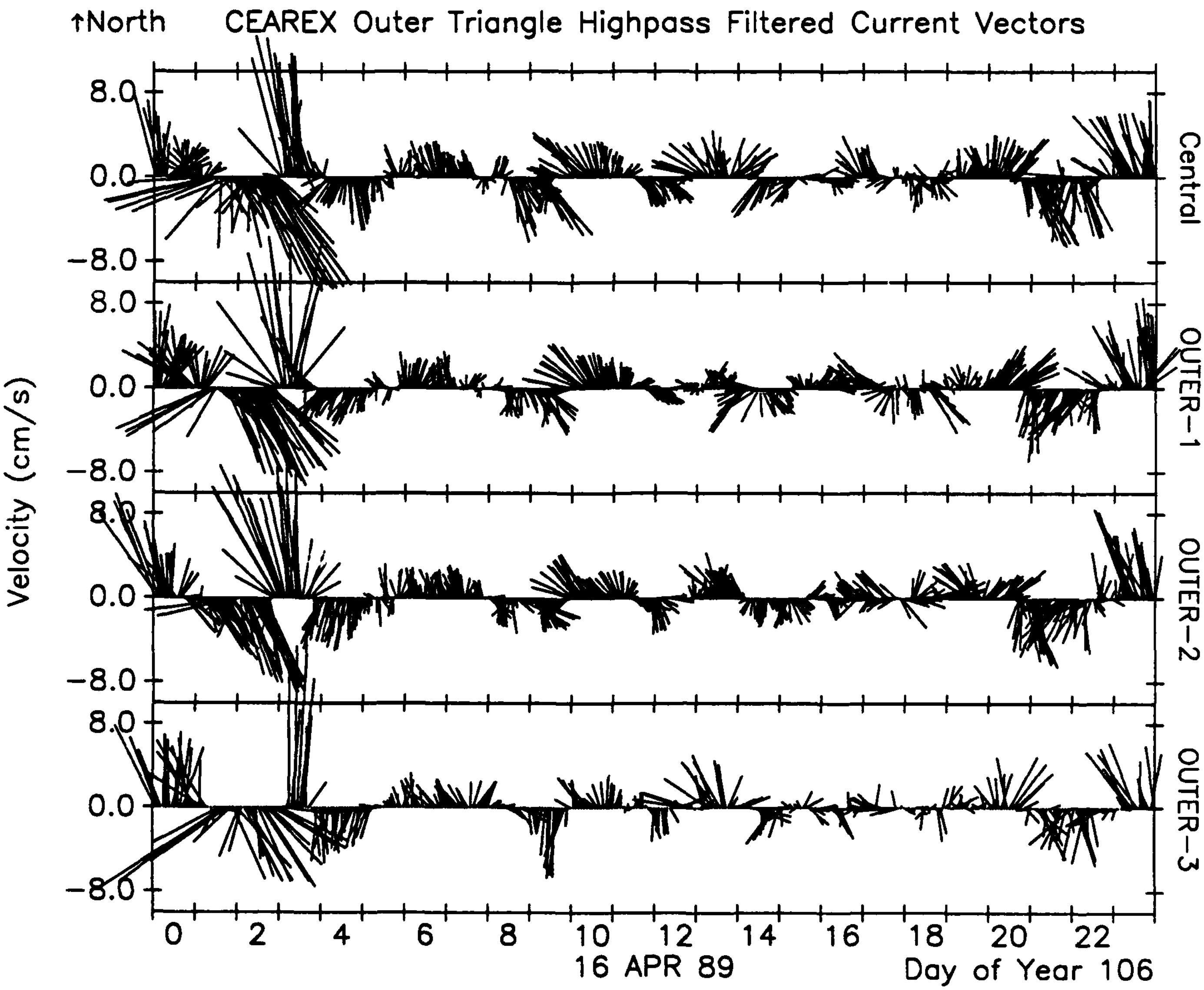

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
11 APR 89
Day of Year 101

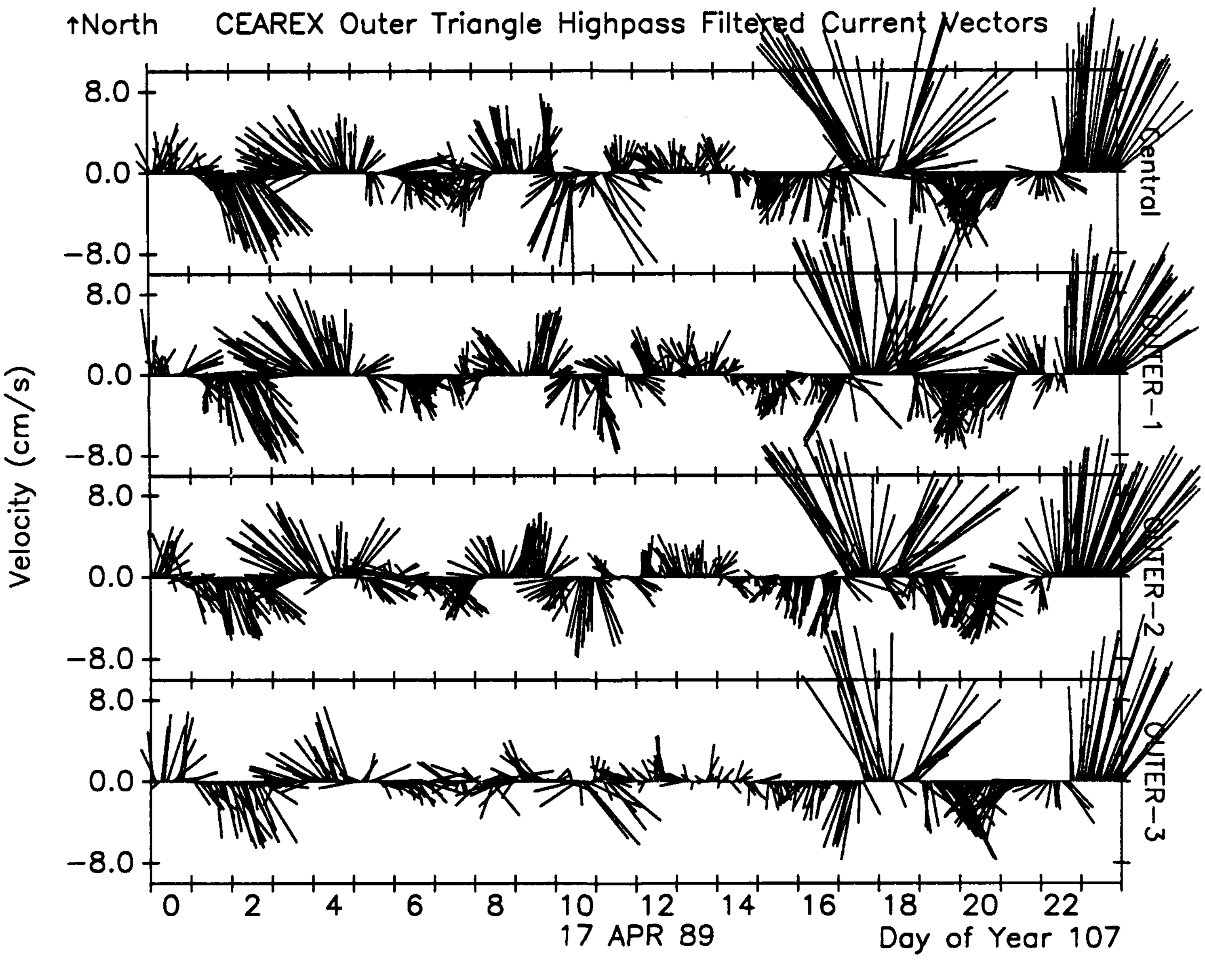

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
0 2 4 6 8 10 12 14 16 18 20 22
12 APR 89
Day of Year 102

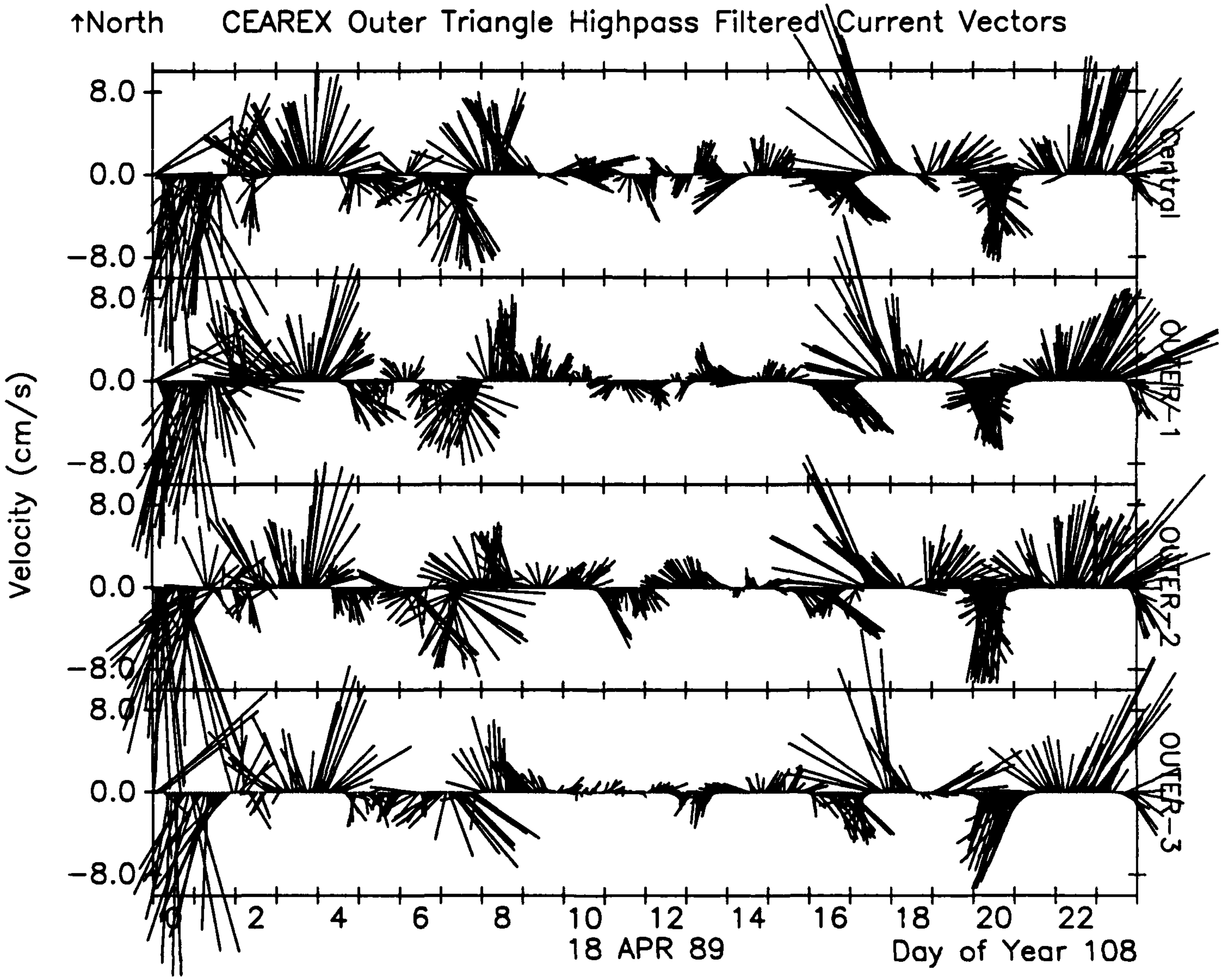

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
13 APR 89
Day of Year 103

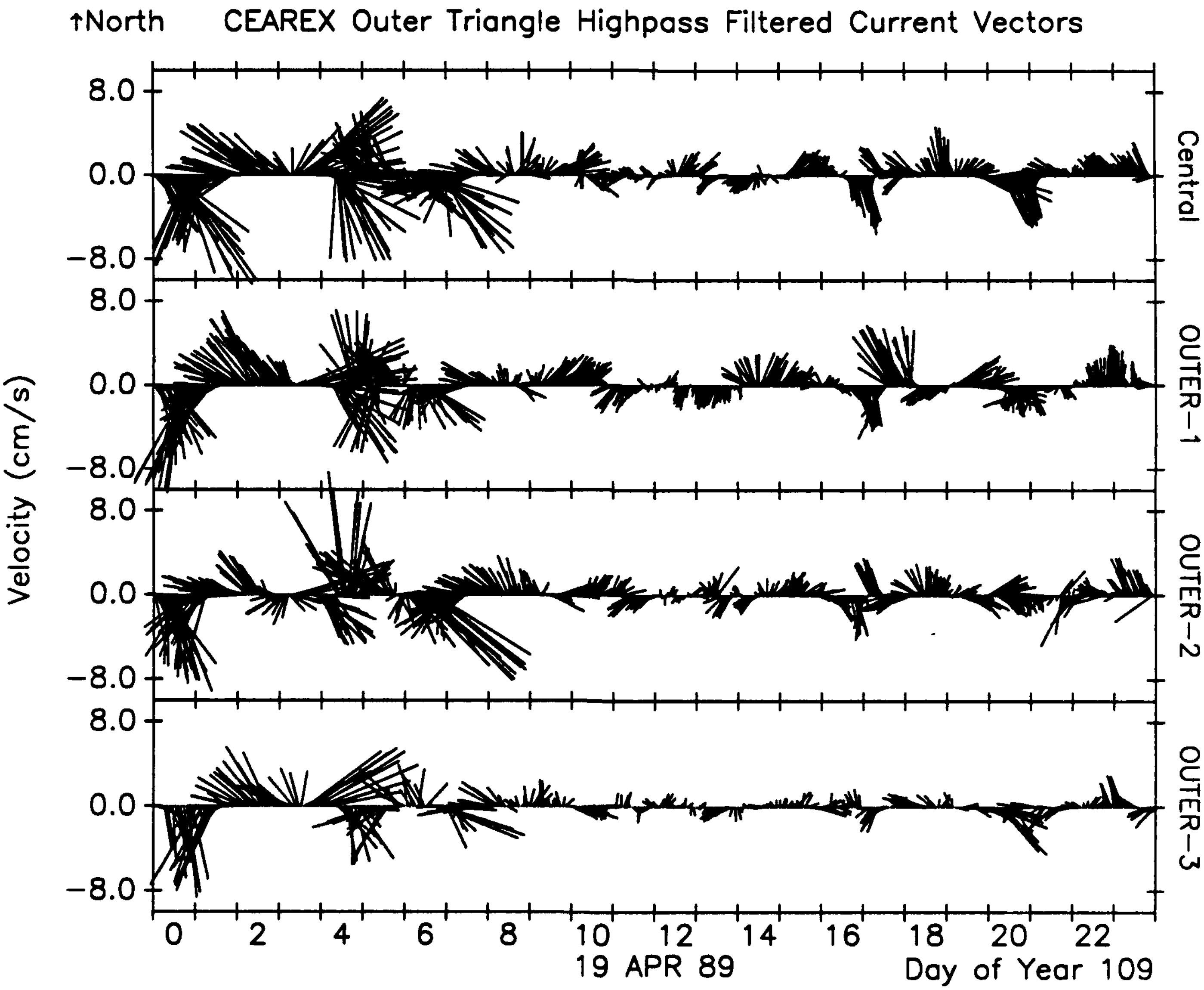

↑North
CEAREX Outer Triangle Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
14 APR 89
Day of Year 104


↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
-8.0
Central
OUTER-1
OUTER-2
OUTER-3
0 2 4 6 8 10 12 14 16 18 20 22
15 APR 89
Day of Year 105

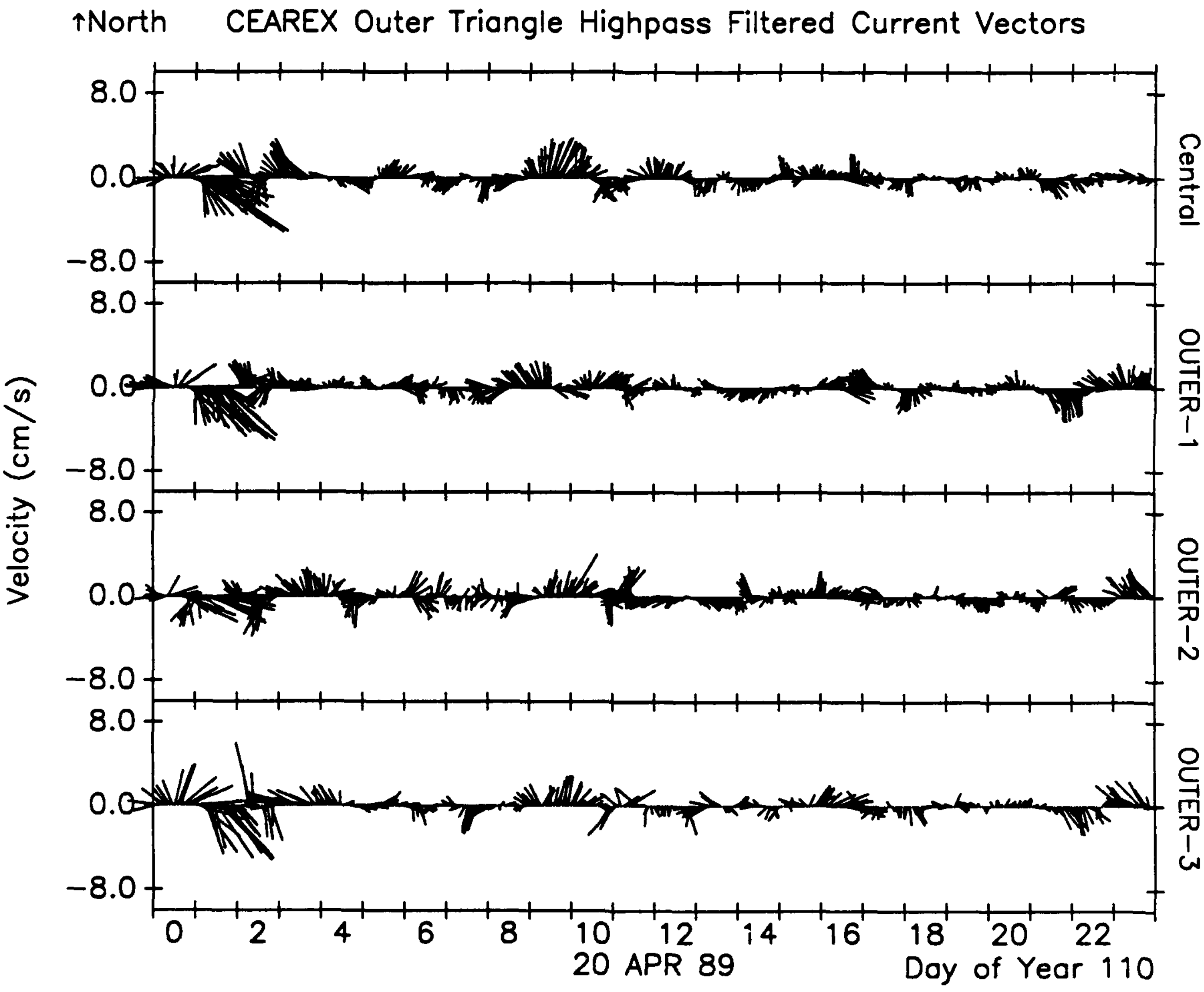

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
16 APR 89
Day of Year 106


↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
0
2
4
6
8
10
12
14
16
18
20
22
17 APR 89
Day of Year 107

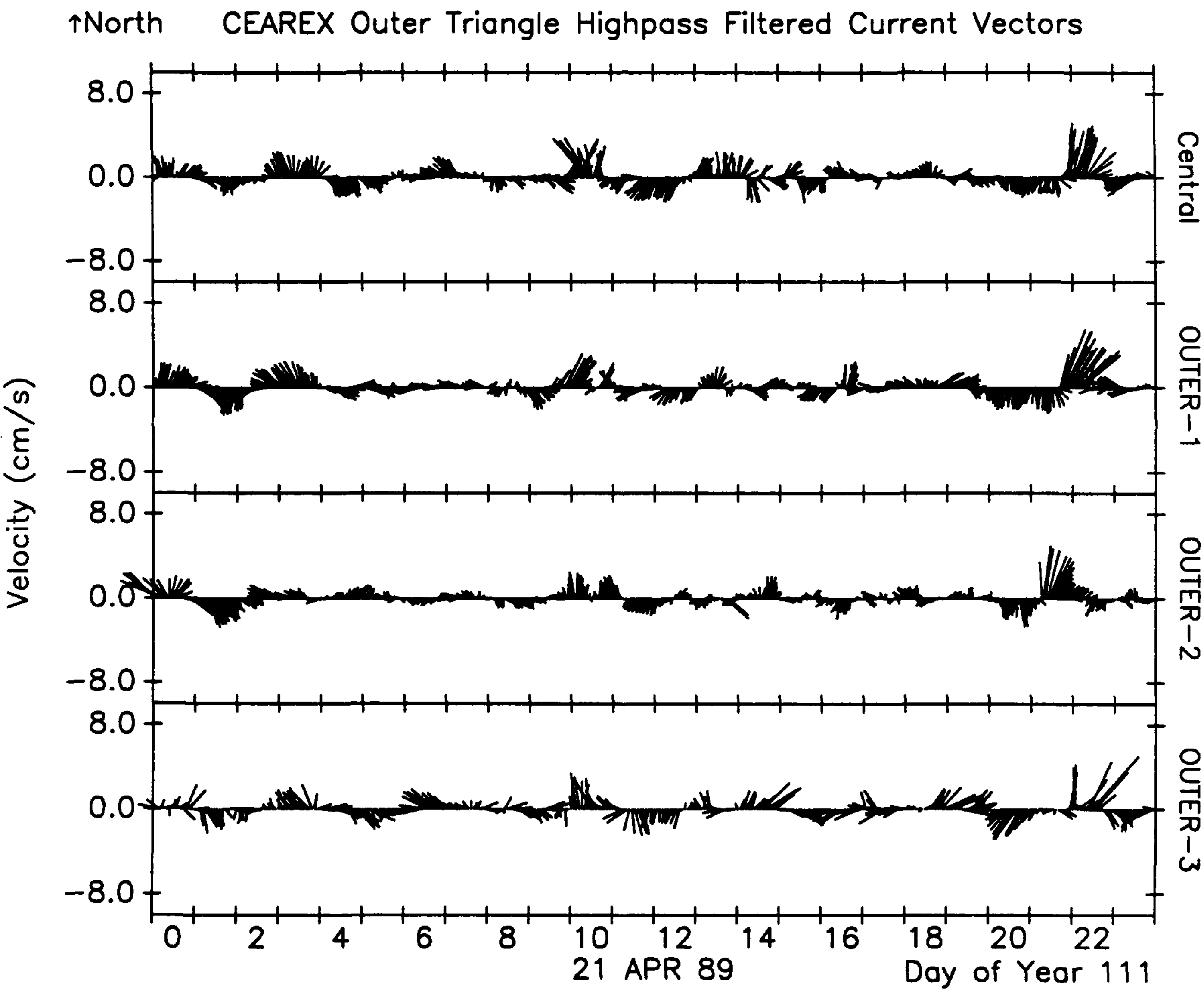

↑North
CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
-8.0
8.0
0.0
-8.0
8.0
0.0
-8.0
8.0
0.0
-8.0
Velocity (cm/s)
Central
OUTER-1
OUTER-2
OUTER-3
0
2
4
6
8
10
12
14
16
18
20
22
18 APR 89
Day of Year 108

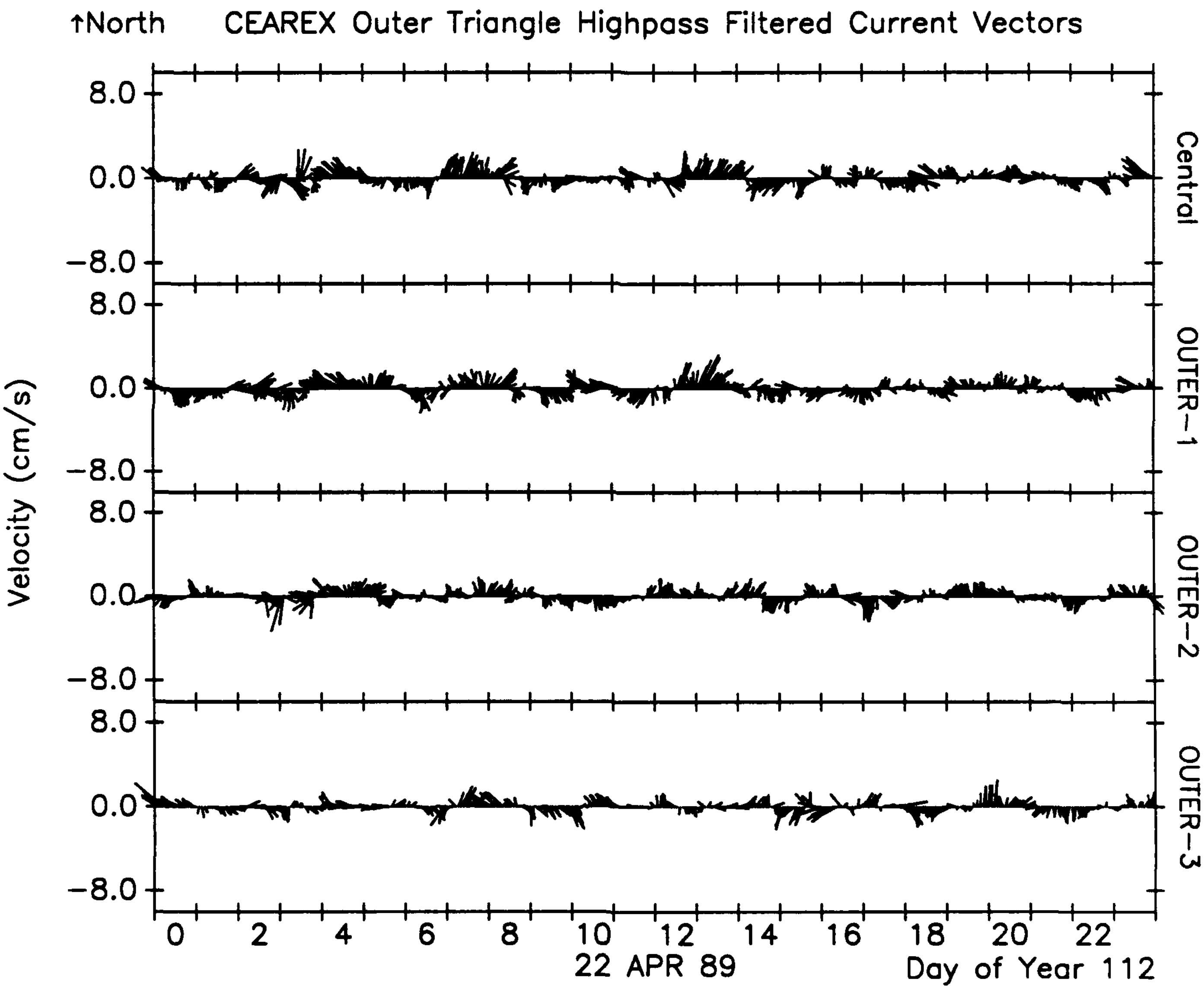


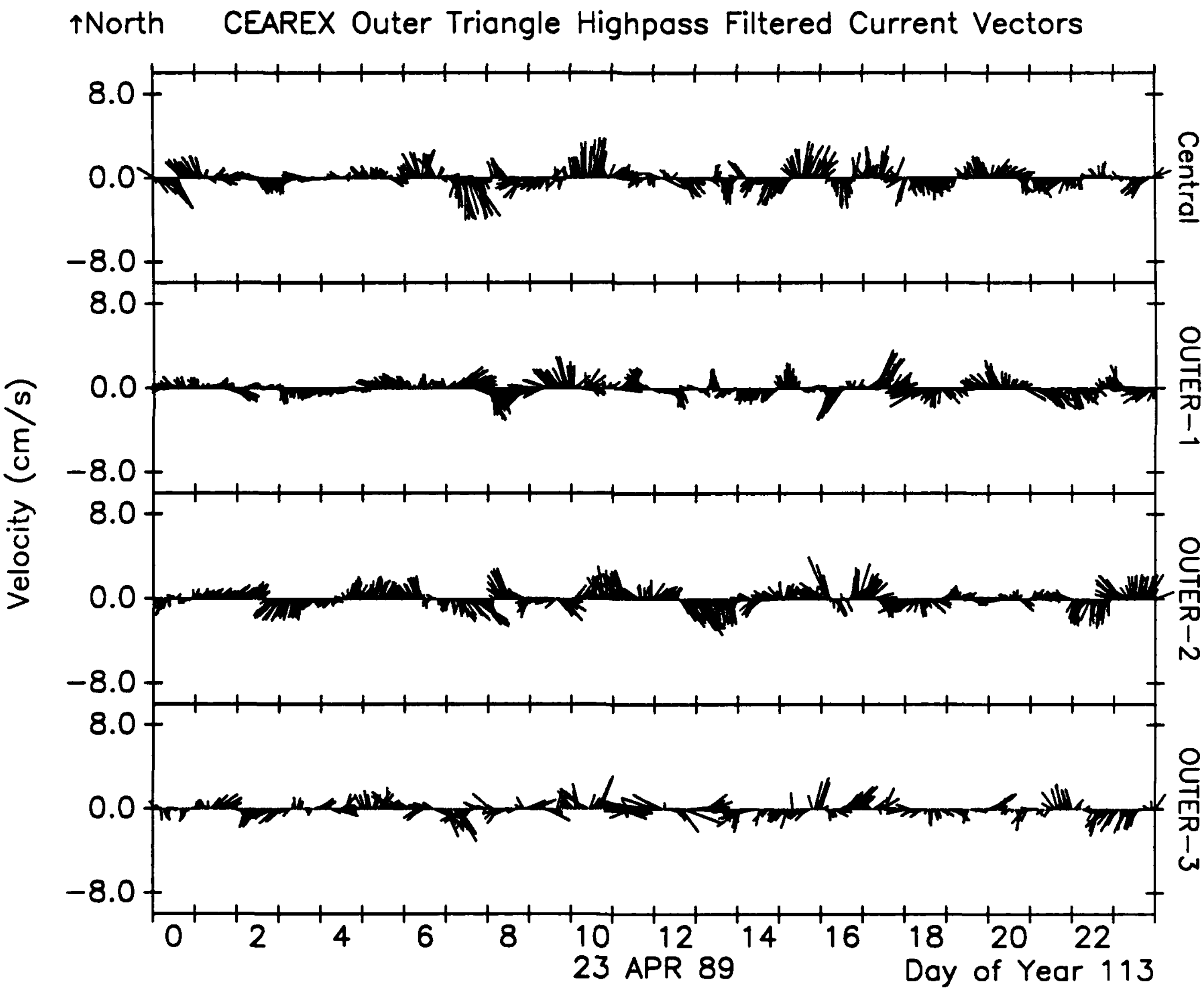
↑North
CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
19 APR 89
Day of Year 109

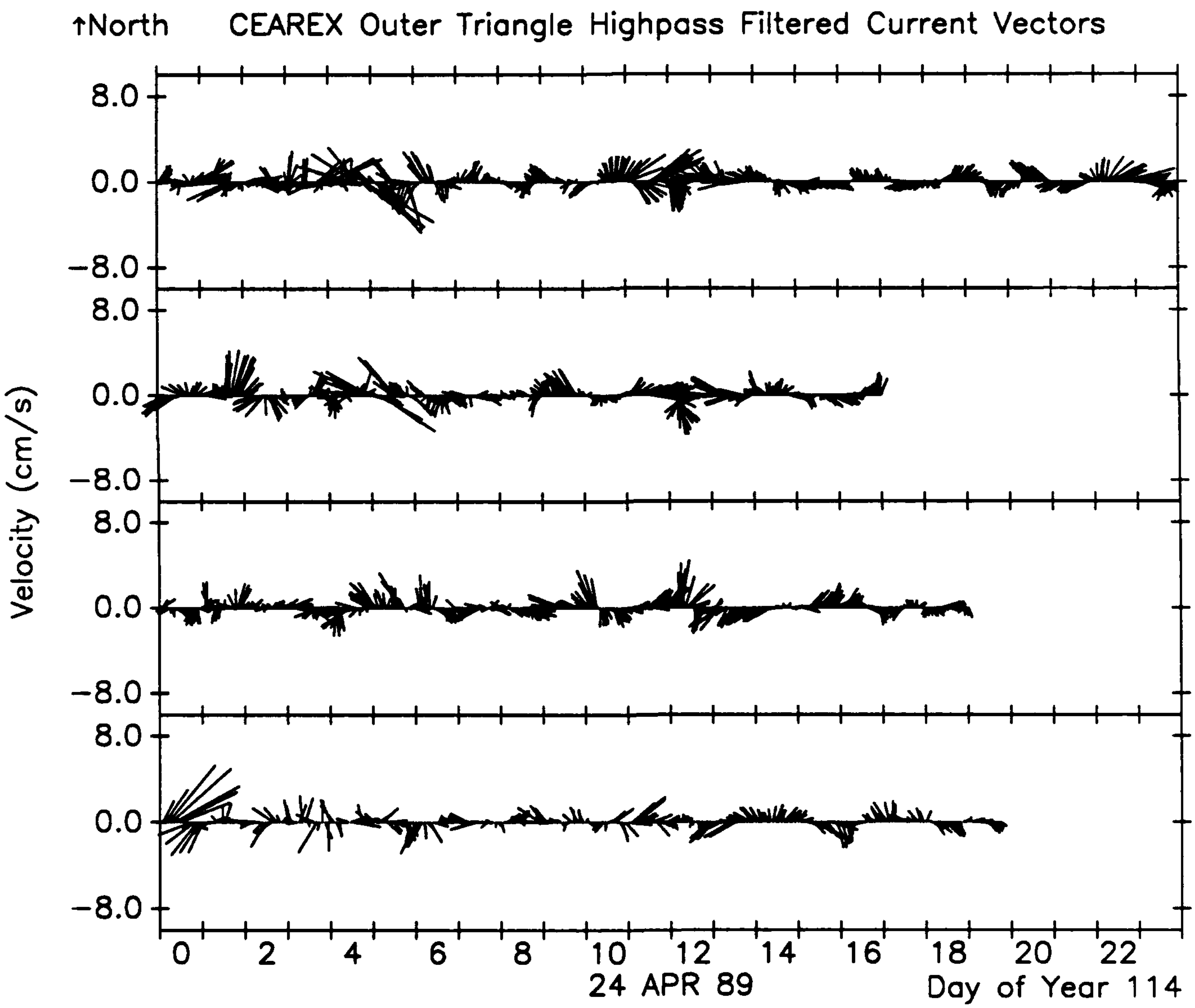


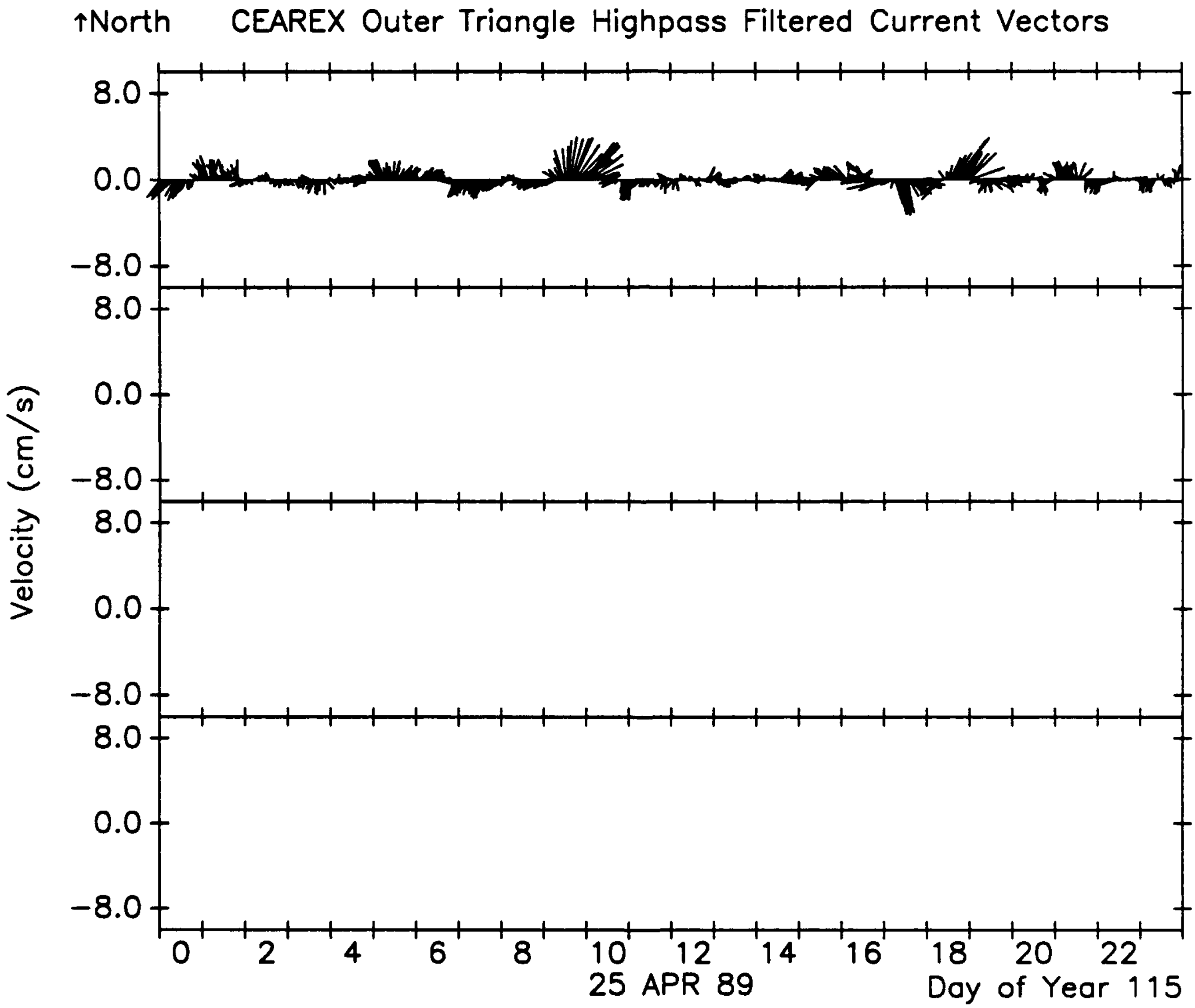
↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
-8.0
Central
OUTER-1
OUTER-2
OUTER-3
0 2 4 6 8 10 12 14 16 18 20 22
20 APR 89
Day of Year 110

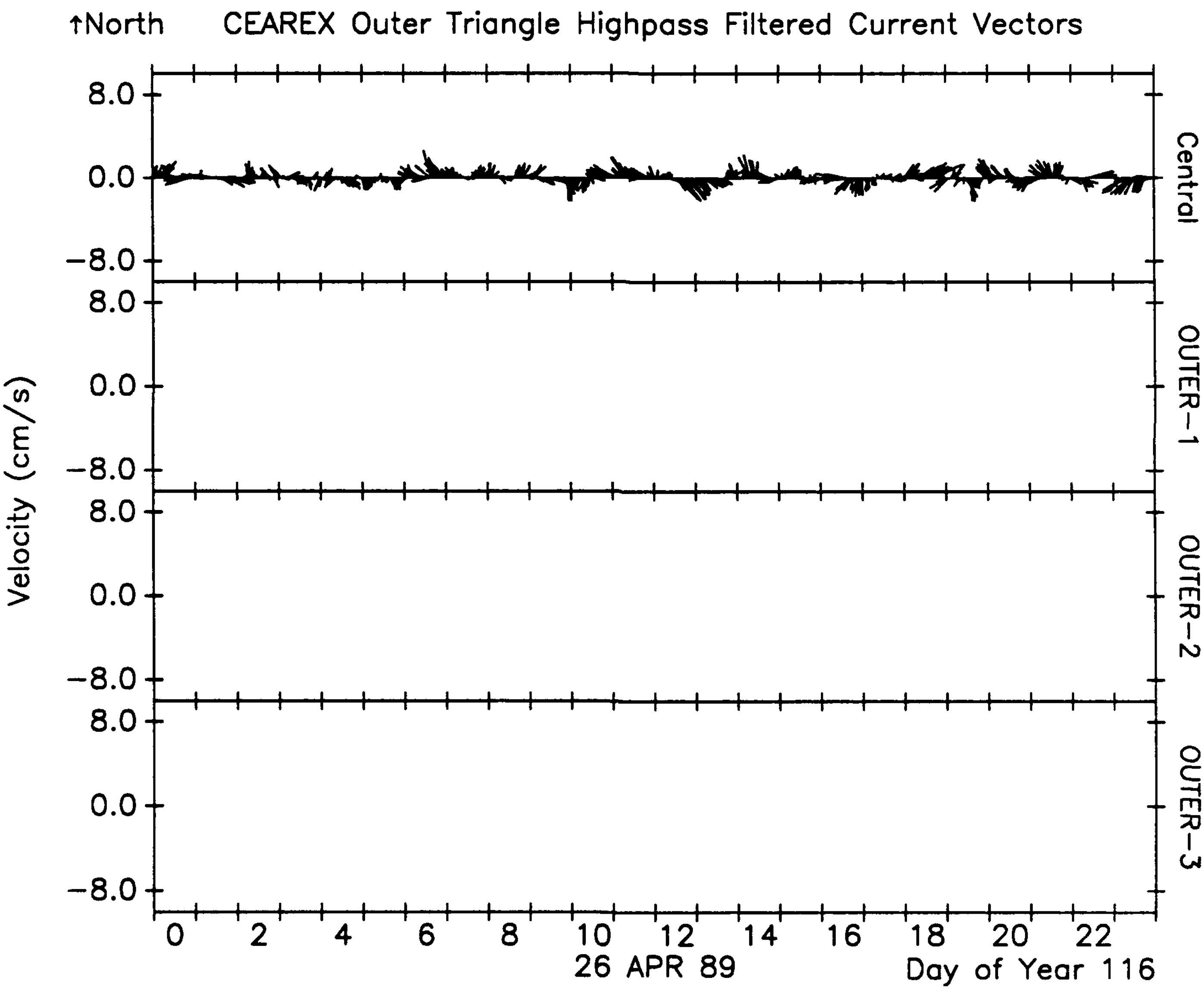

↑North
CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
-8.0
Central
OUTER-1
OUTER-2
OUTER-3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
21 APR 89
Day of Year 111


↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
22 APR 89
Day of Year 112

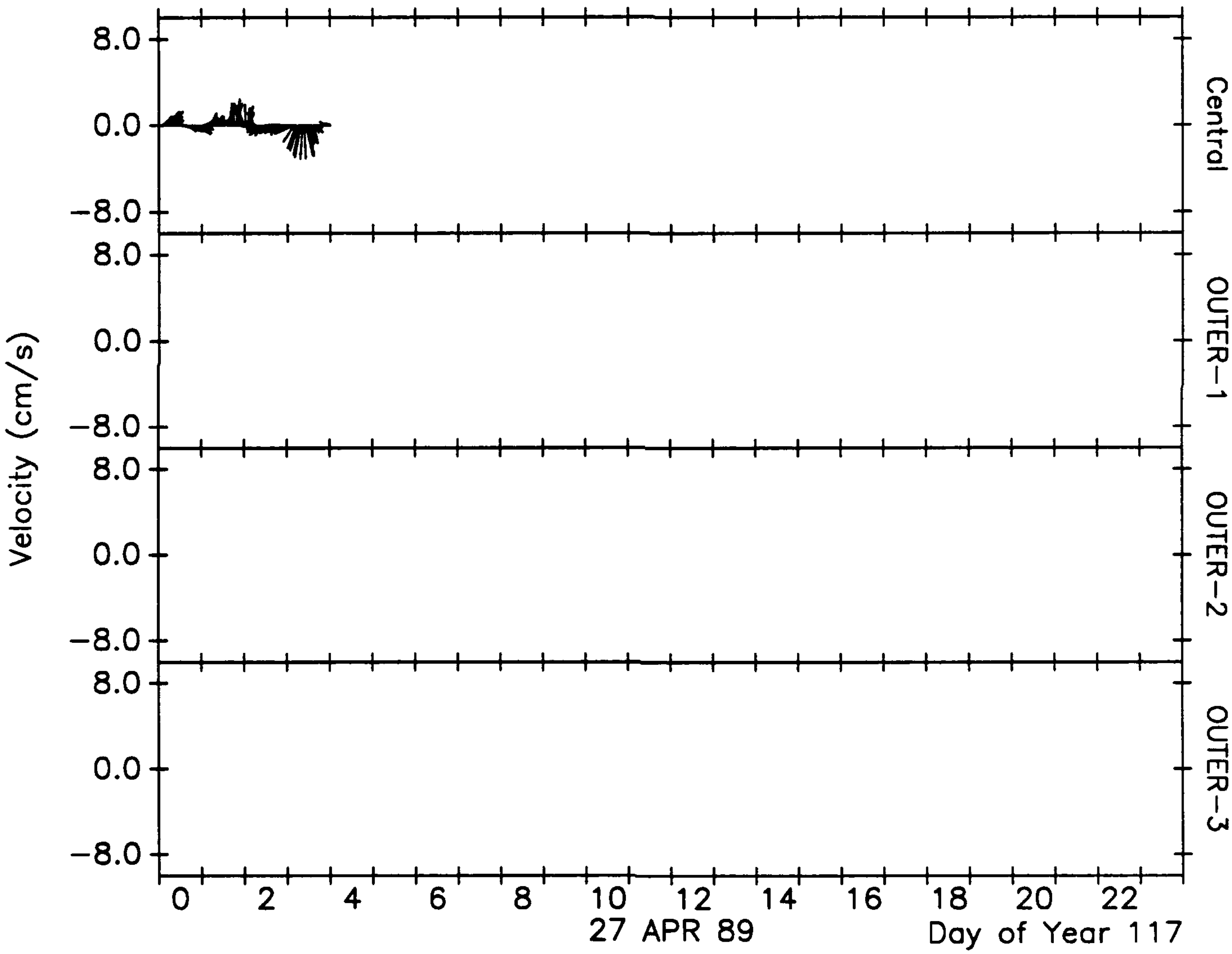

↑North
CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
23 APR 89
Day of Year 113


↑North
CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
-8.0
Velocity (cm/s)
Central
OUTER-1
OUTER-2
OUTER-3
0
2
4
6
8
10
12
14
16
18
20
22
24 APR 89
Day of Year 114


↑North
CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
25 APR 89
Day of Year 115

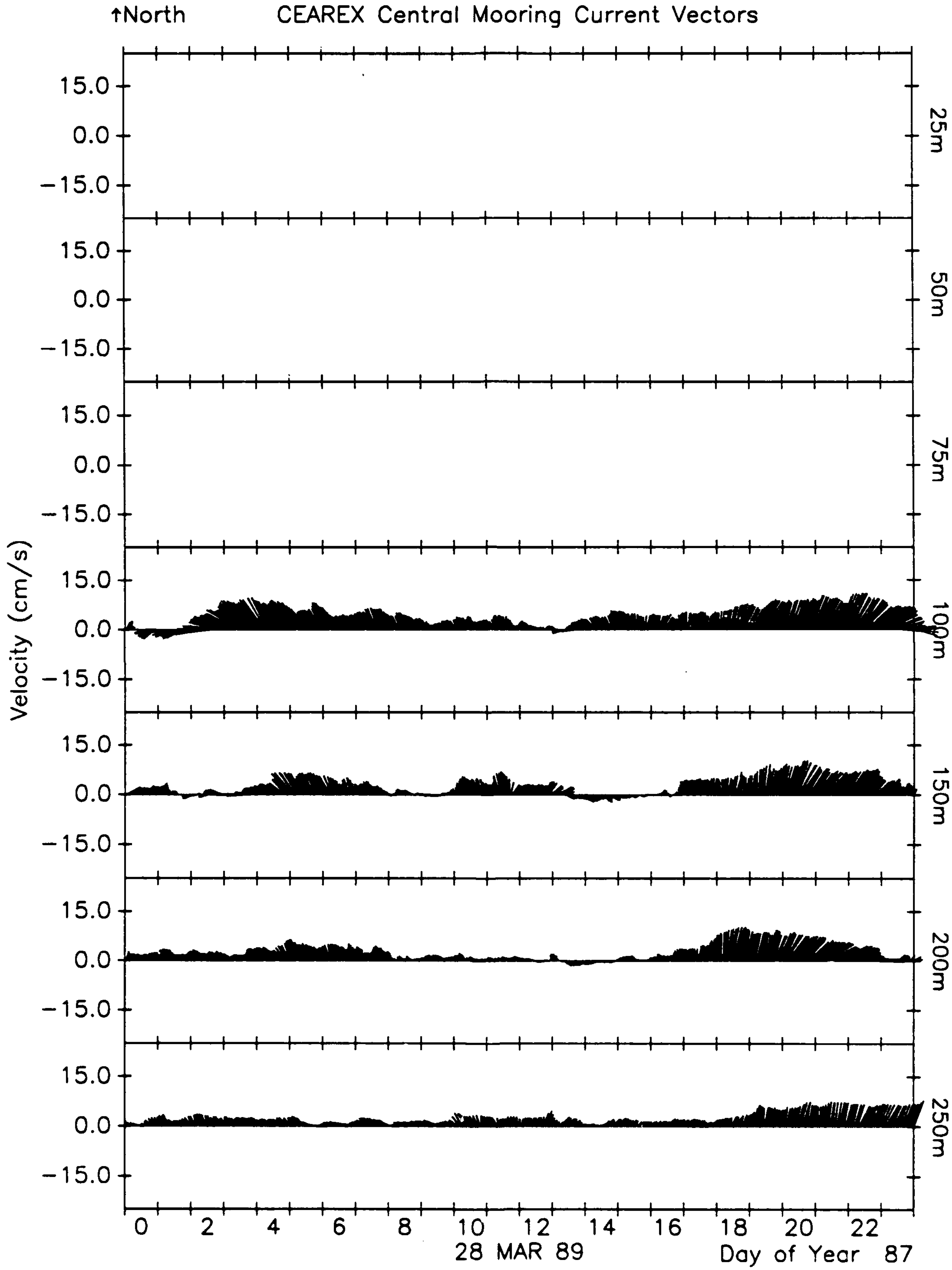

↑North CEAREX Outer Triangle Highpass Filtered Current Vectors
8.0
0.0
−8.0
Central
OUTER−1
OUTER−2
OUTER−3
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
26 APR 89
Day of Year 116

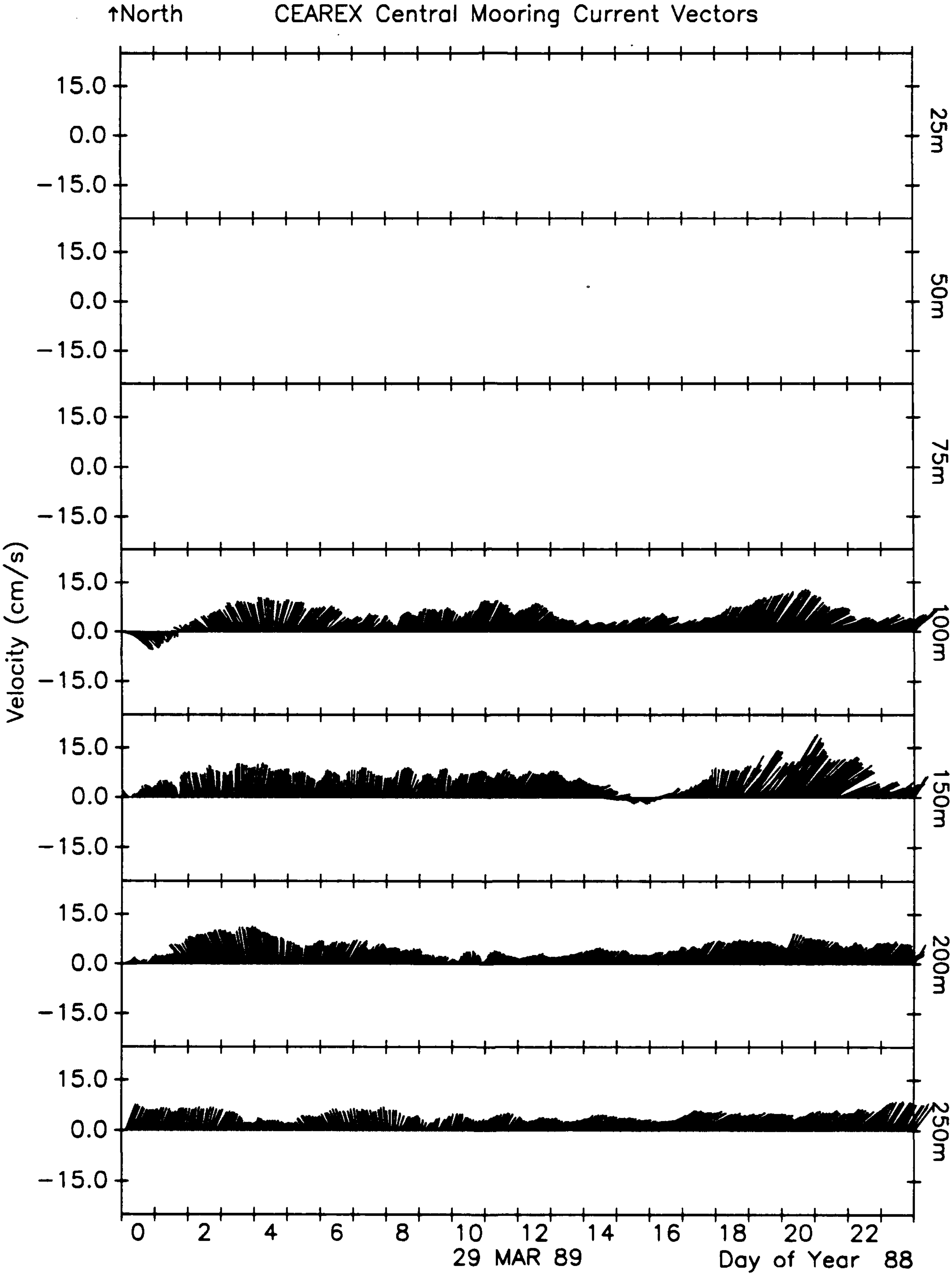
↑North CEAREX Outer Triangle Highpass Filtered Current Vectors

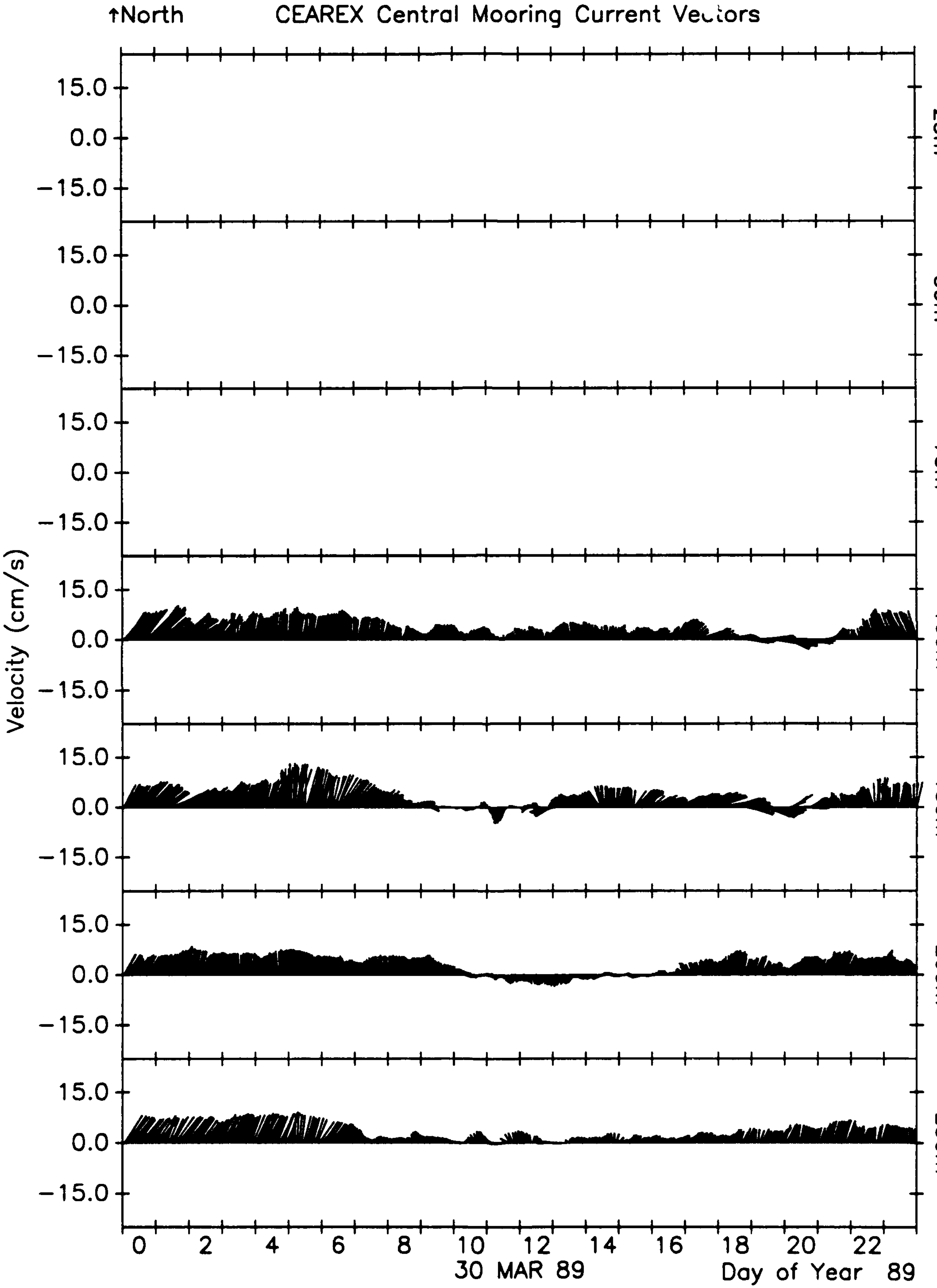


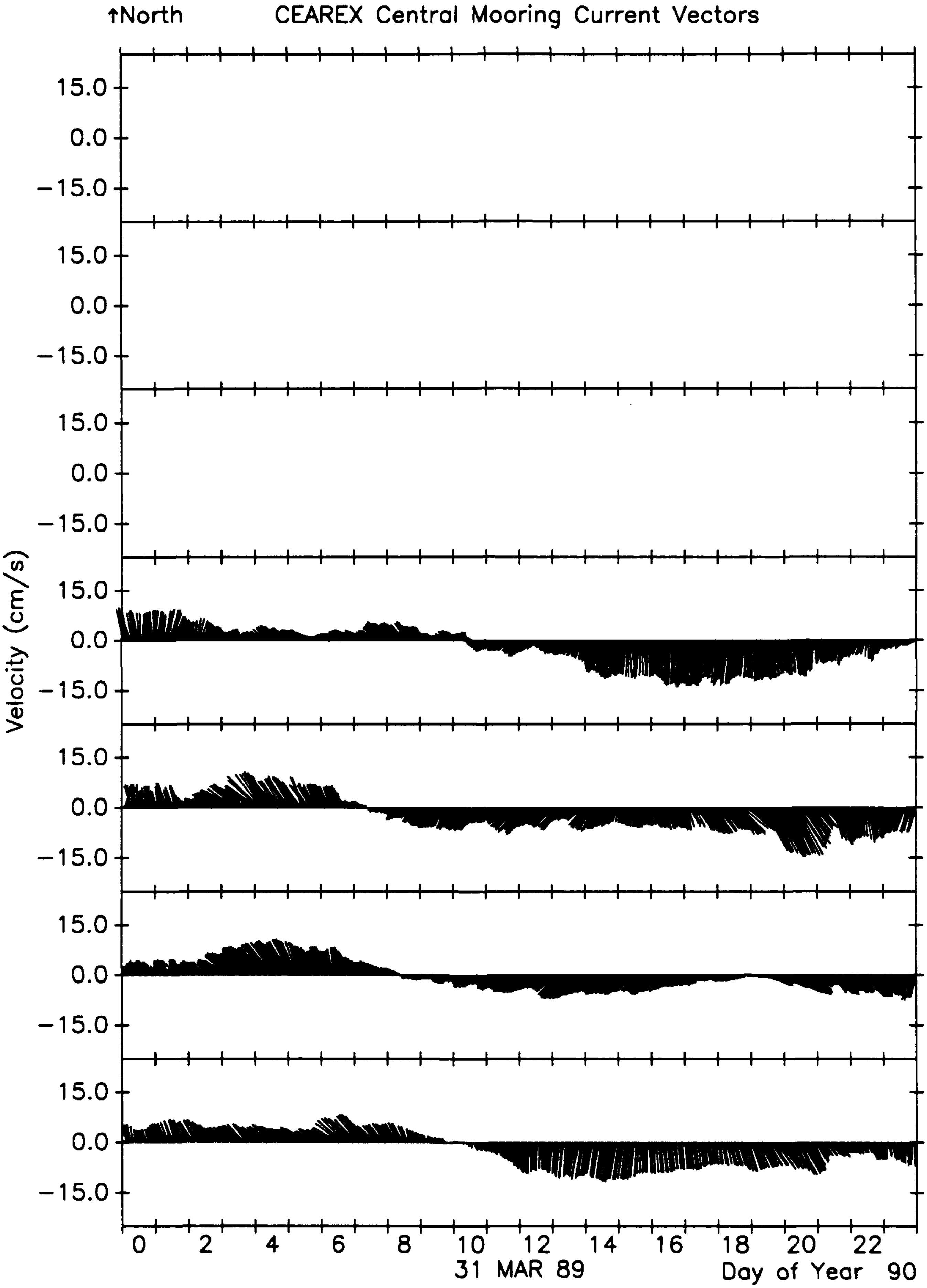
TIME SERIES OF VELOCITY AT CENTRAL SITE: UNFILTERED

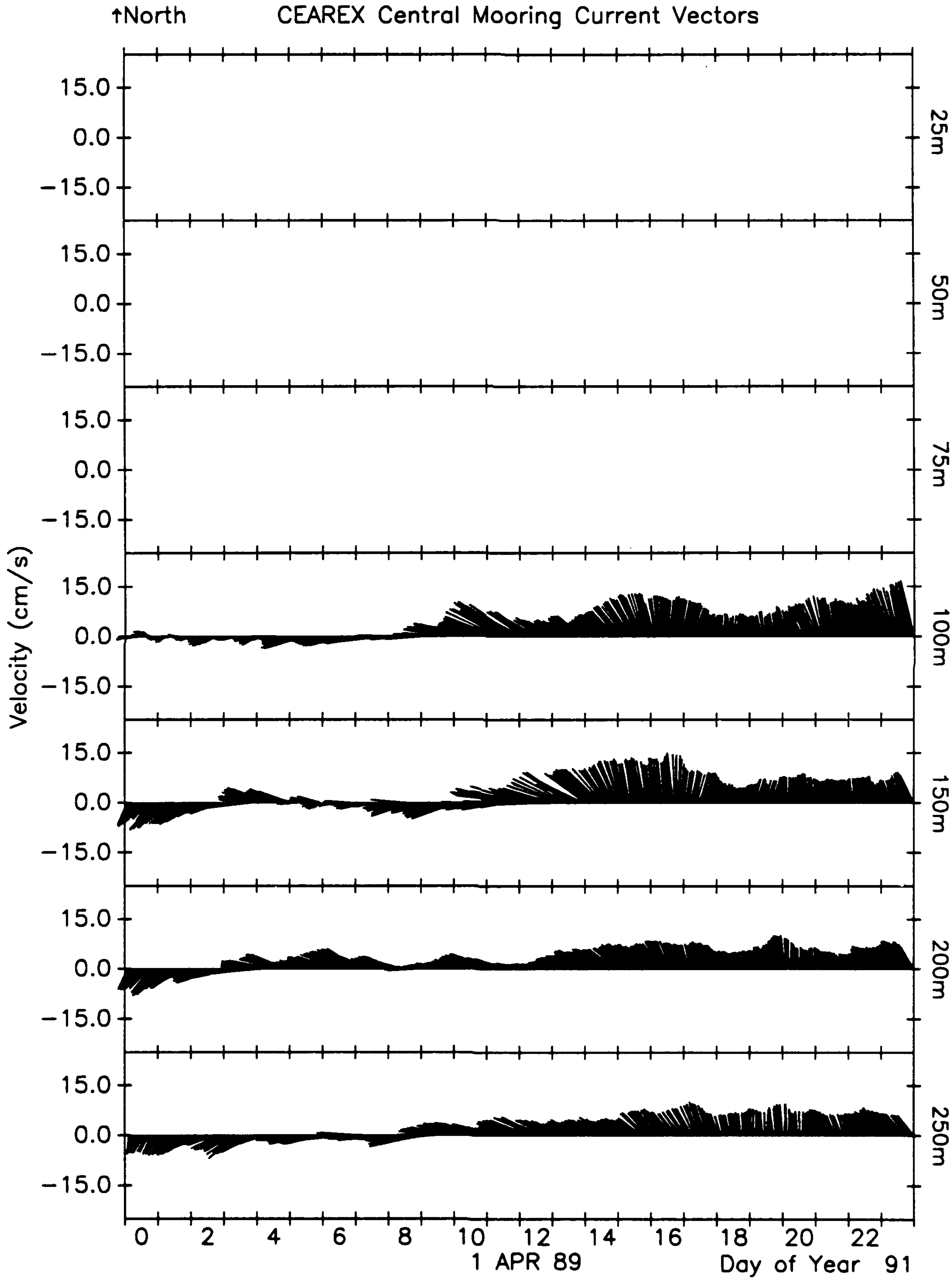
On the following 32 pages are observations of velocity from the Central site at depths of 25, 50, 75, 100, 150, 200 and 250 m. The data above 100 m is from the ADCP; the records at 100 m and deeper are from S-4 current meters. Note: absolute velocities are presented after the start of April 4; relative velocities are shown before. (See Tables 1 and 2.)


↑North
CEAREX Central Mooring Current Vectors
15.0
0.0
−15.0
Velocity (cm/s)
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
28 MAR 89
Day of Year 87

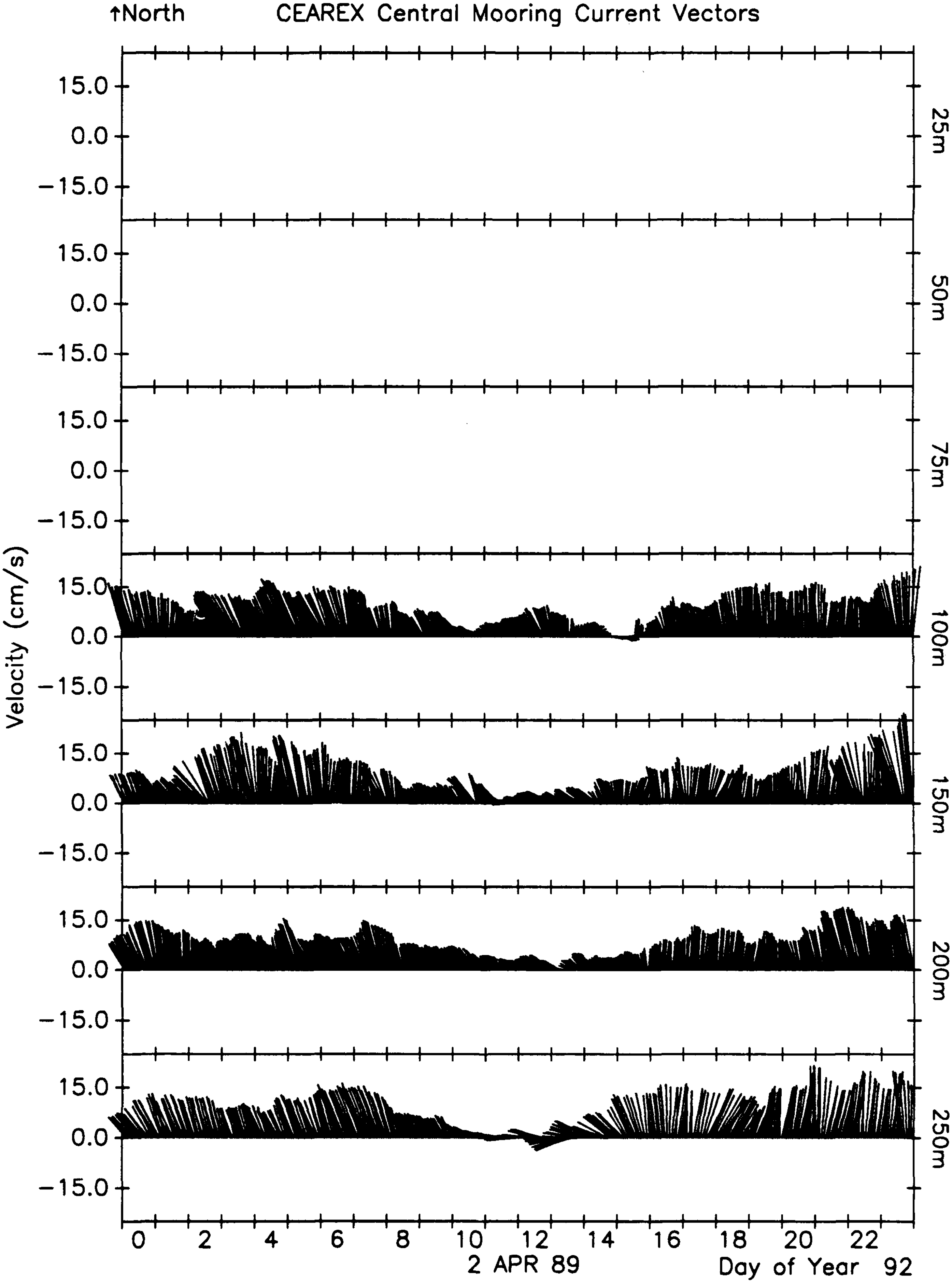

↑North
CEAREX Central Mooring Current Vectors
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
29 MAR 89
Day of Year 88

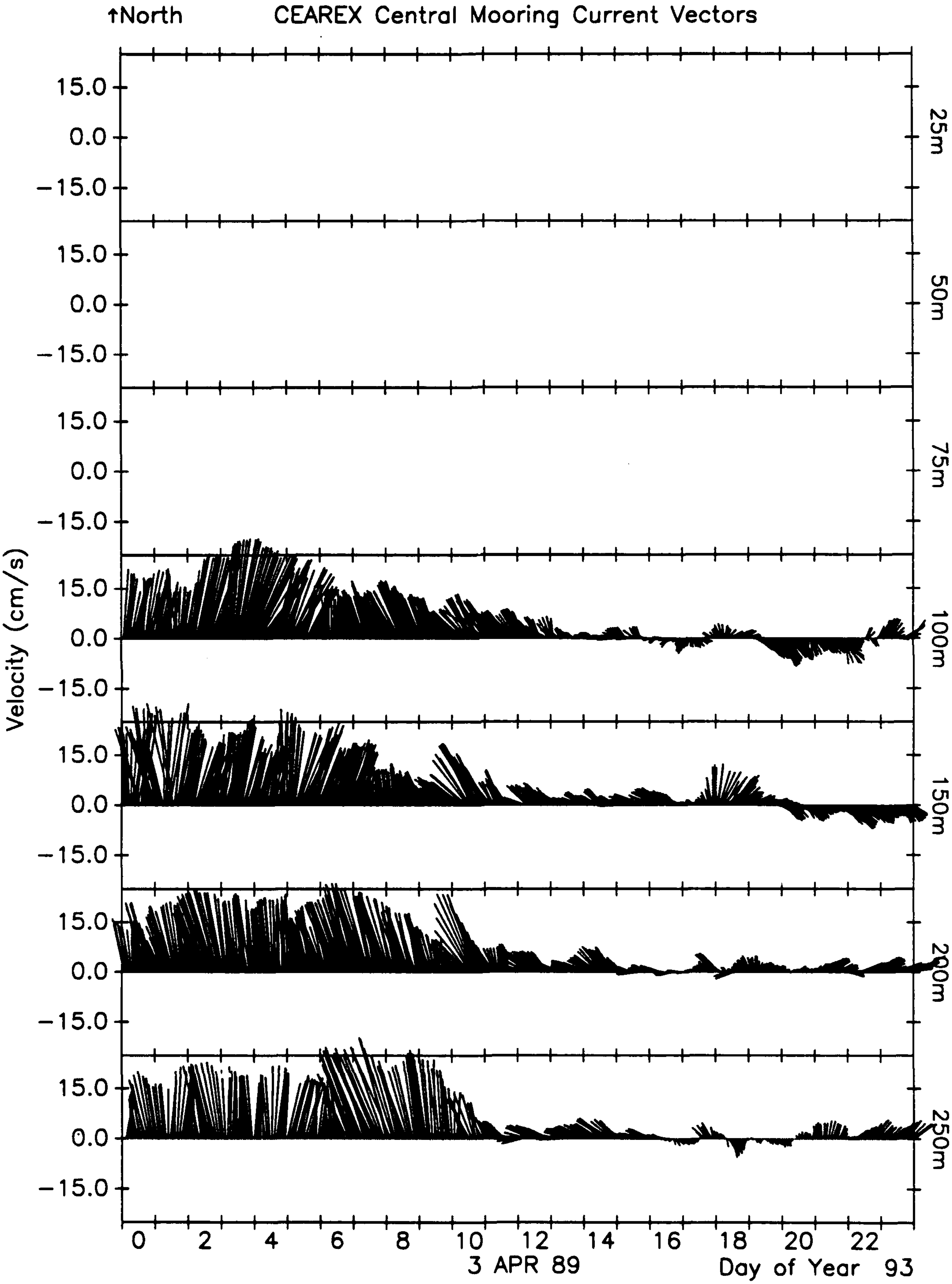

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
30 MAR 89
Day of Year 89

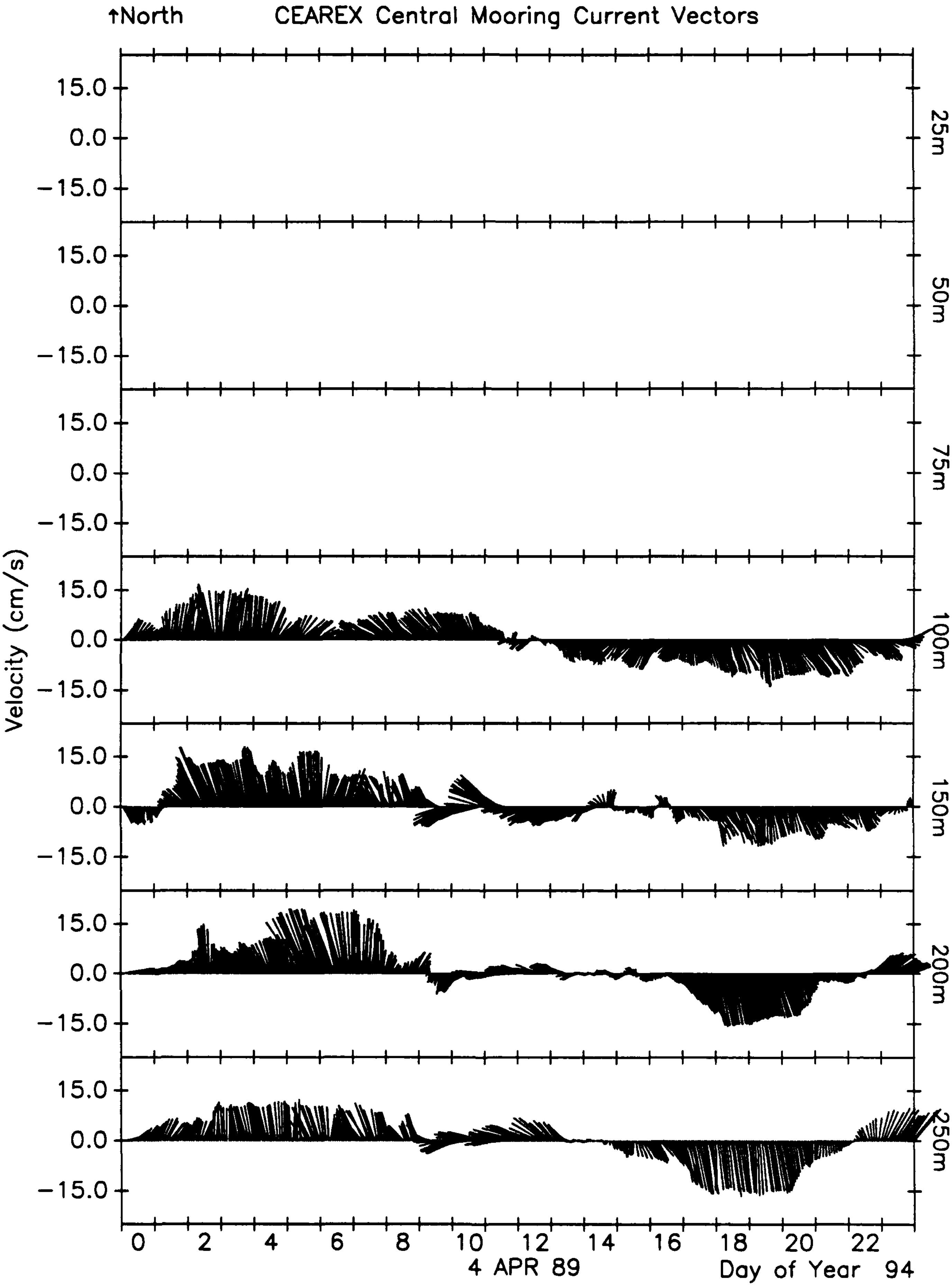

↑North
CEAREX Central Mooring Current Vectors
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
31 MAR 89
Day of Year 90

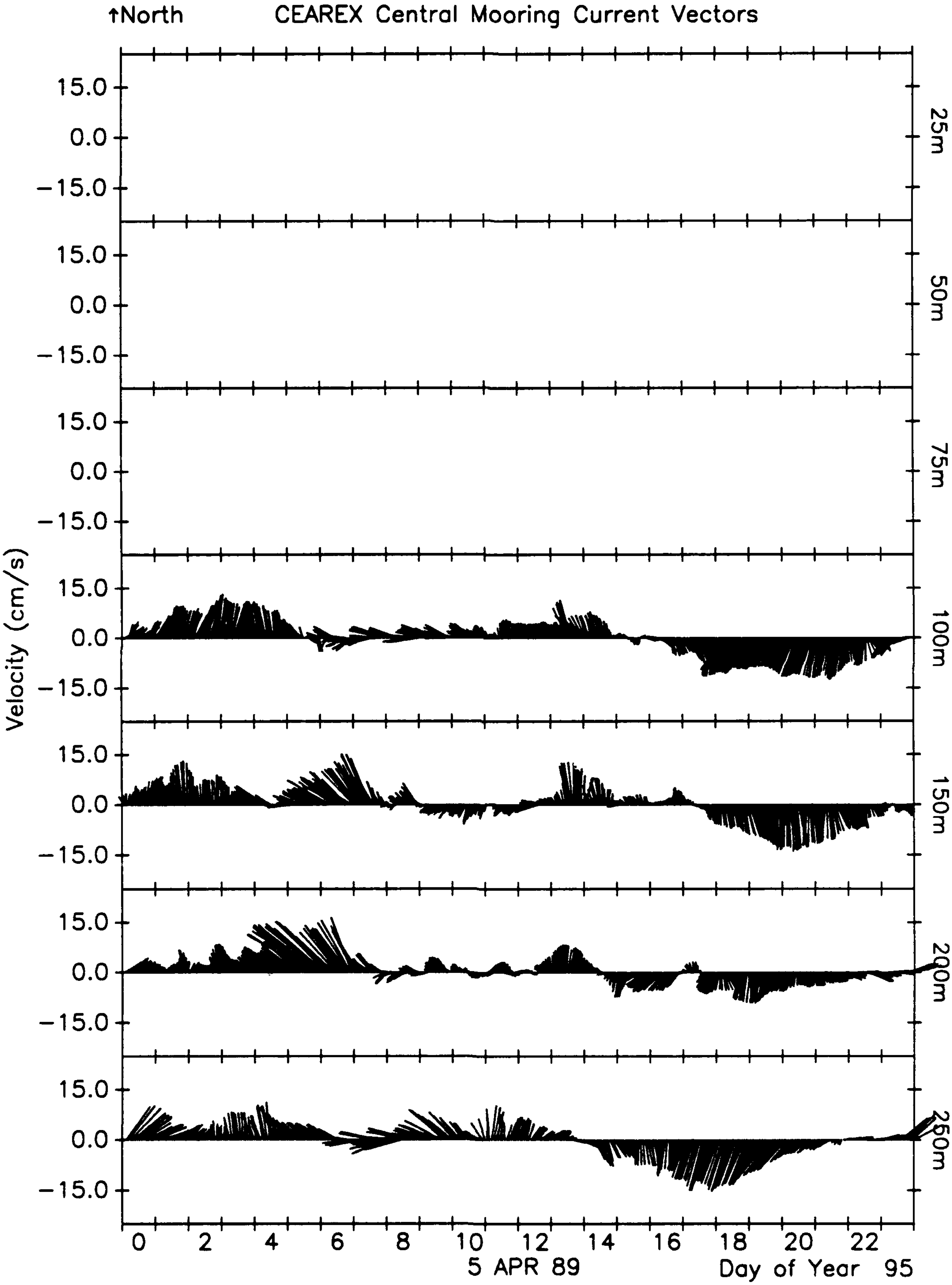


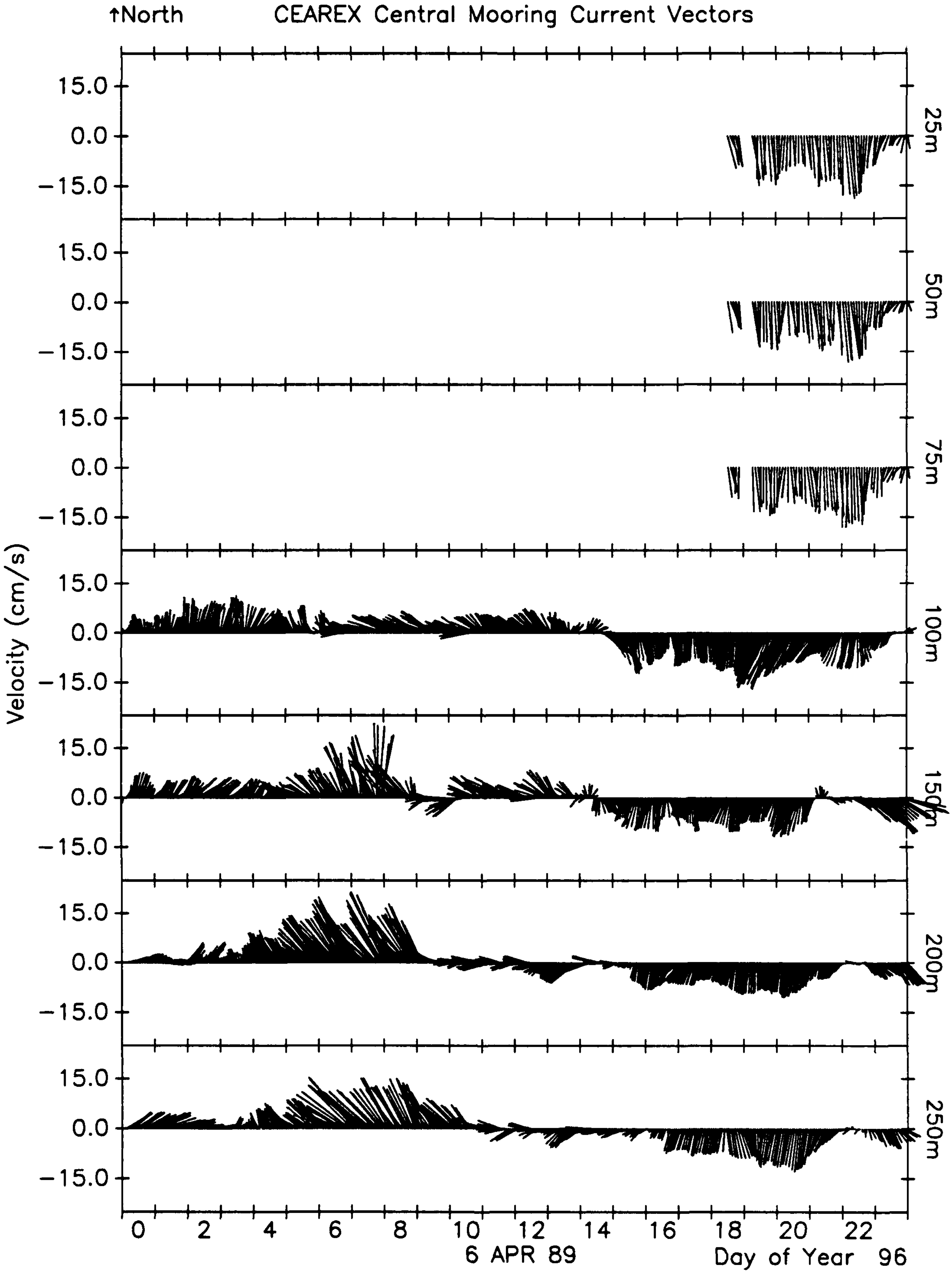
↑North
CEAREX Central Mooring Current Vectors
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
1 APR 89
Day of Year 91

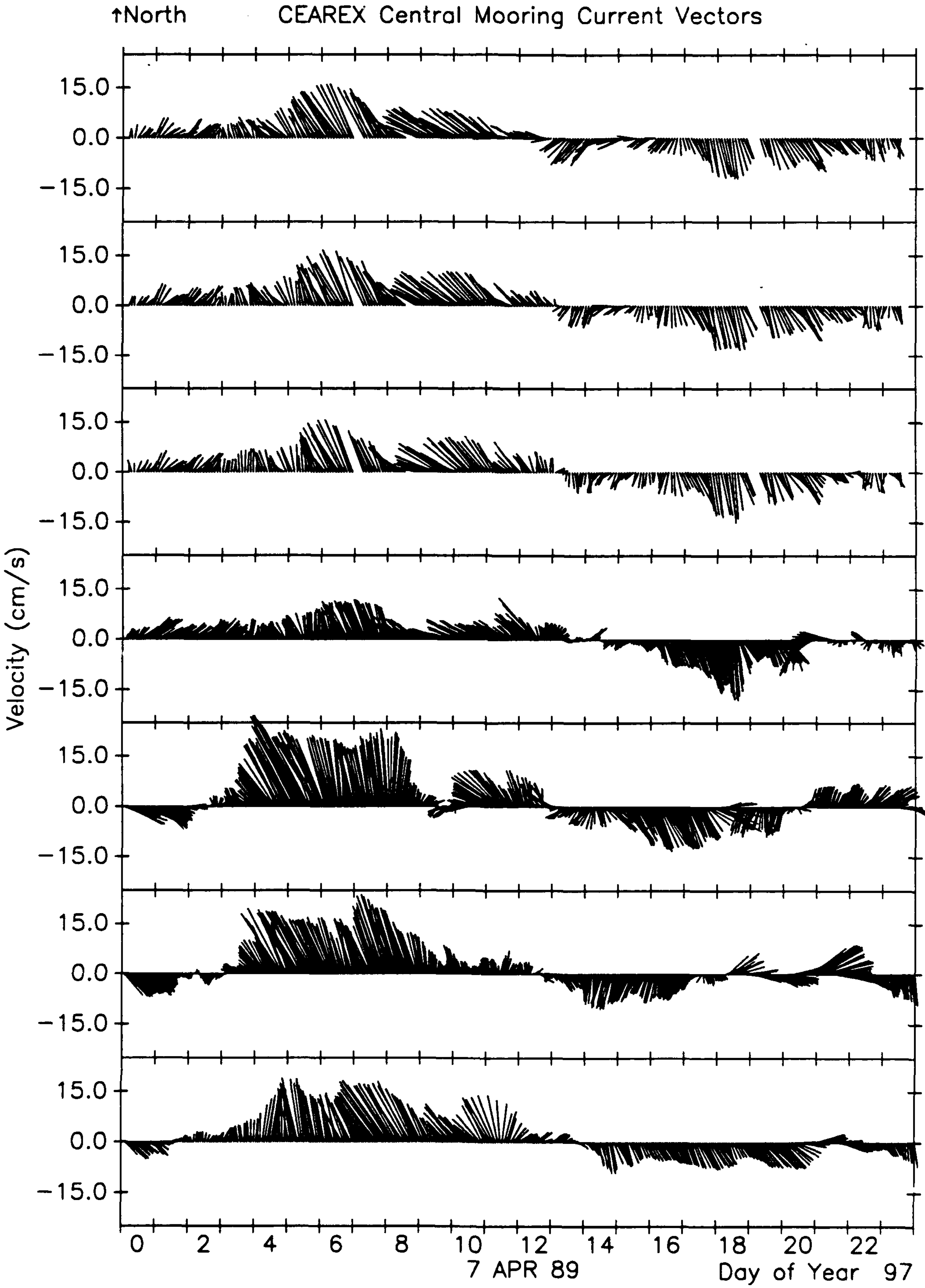

↑North
CEAREX Central Mooring Current Vectors
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
2 APR 89
Day of Year 92

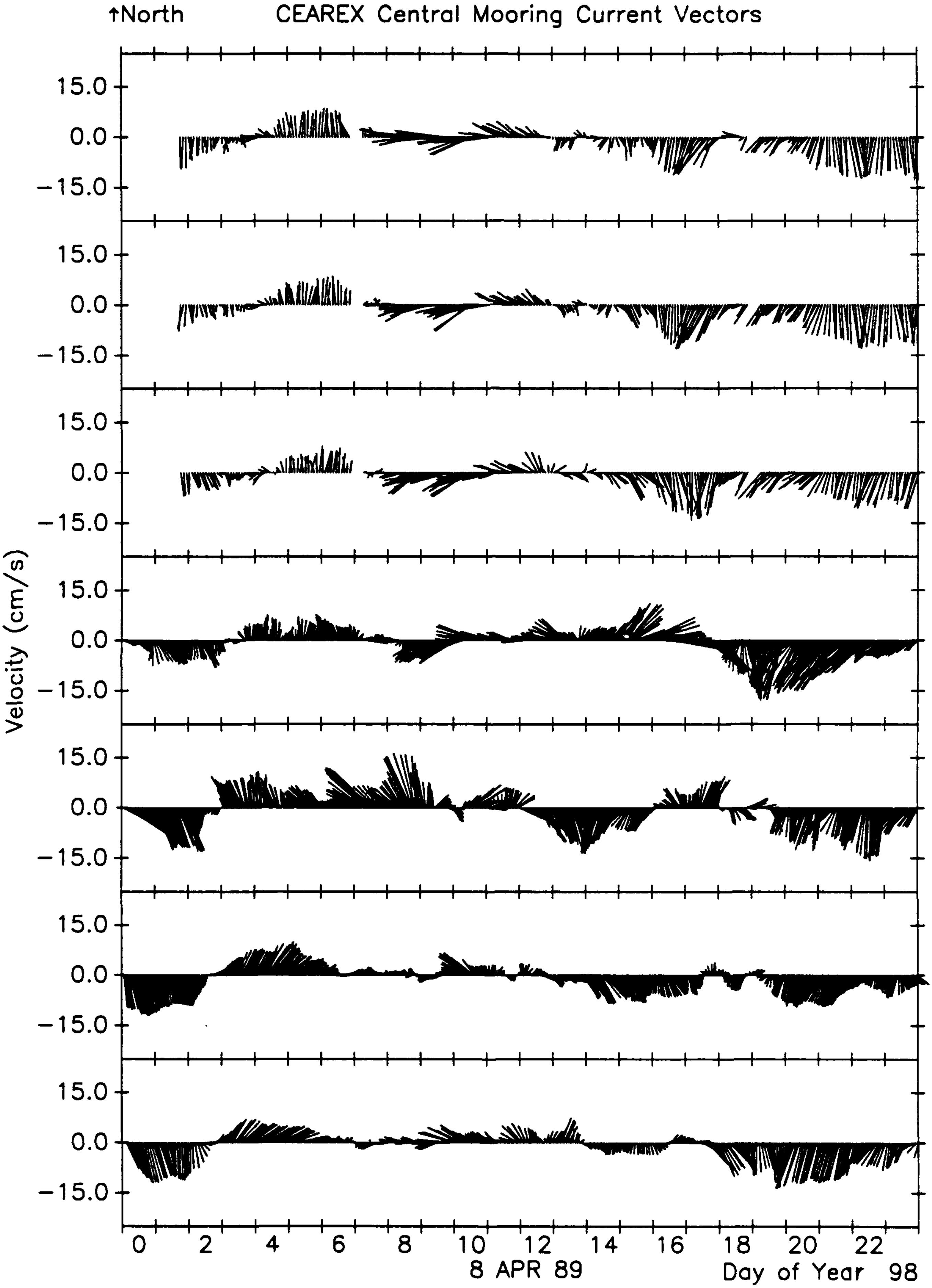

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
3 APR 89
Day of Year 93

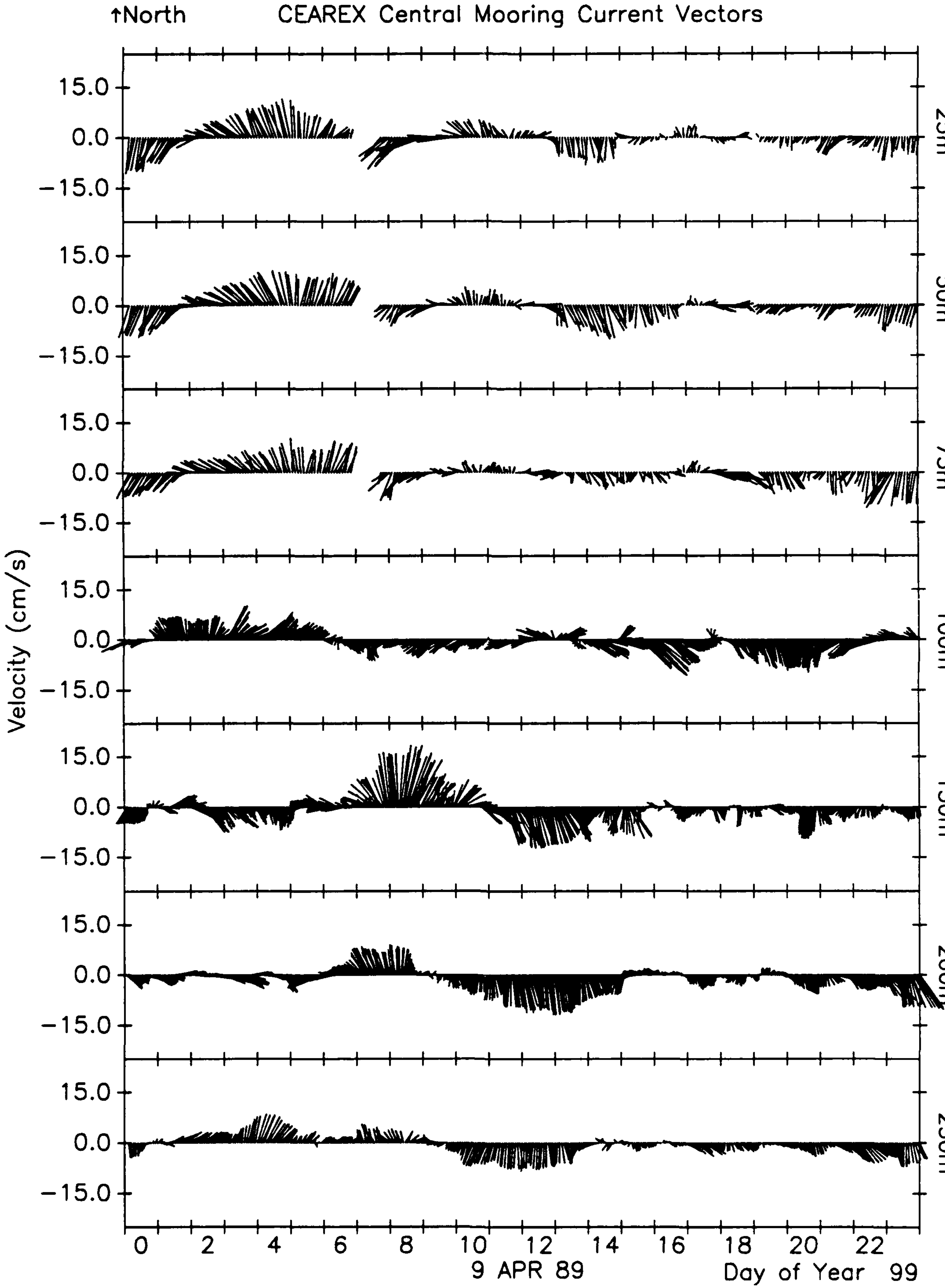

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
4 APR 89
Day of Year 94

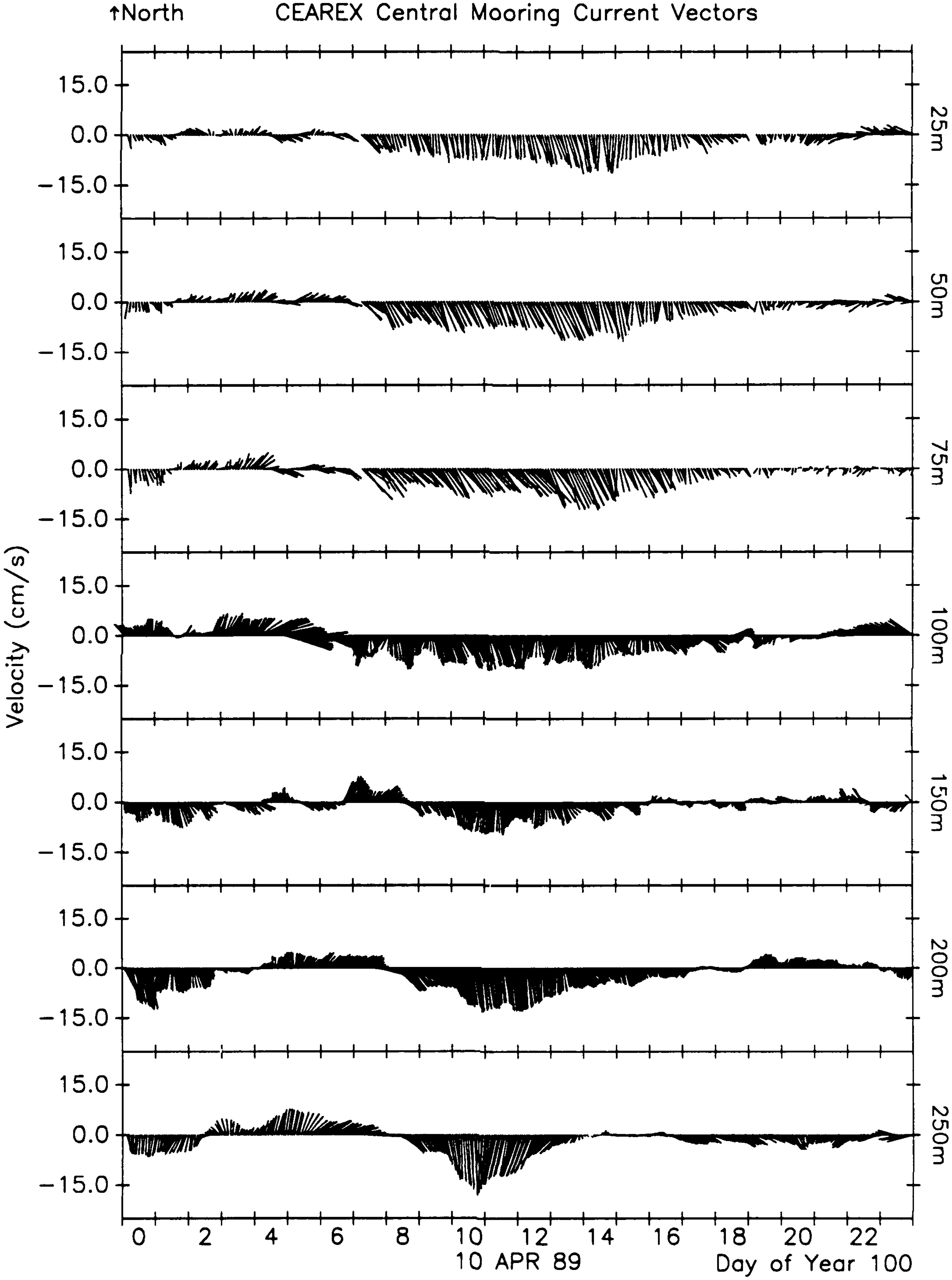

↑North
CEAREX Central Mooring Current Vectors
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
5 APR 89
Day of Year 95

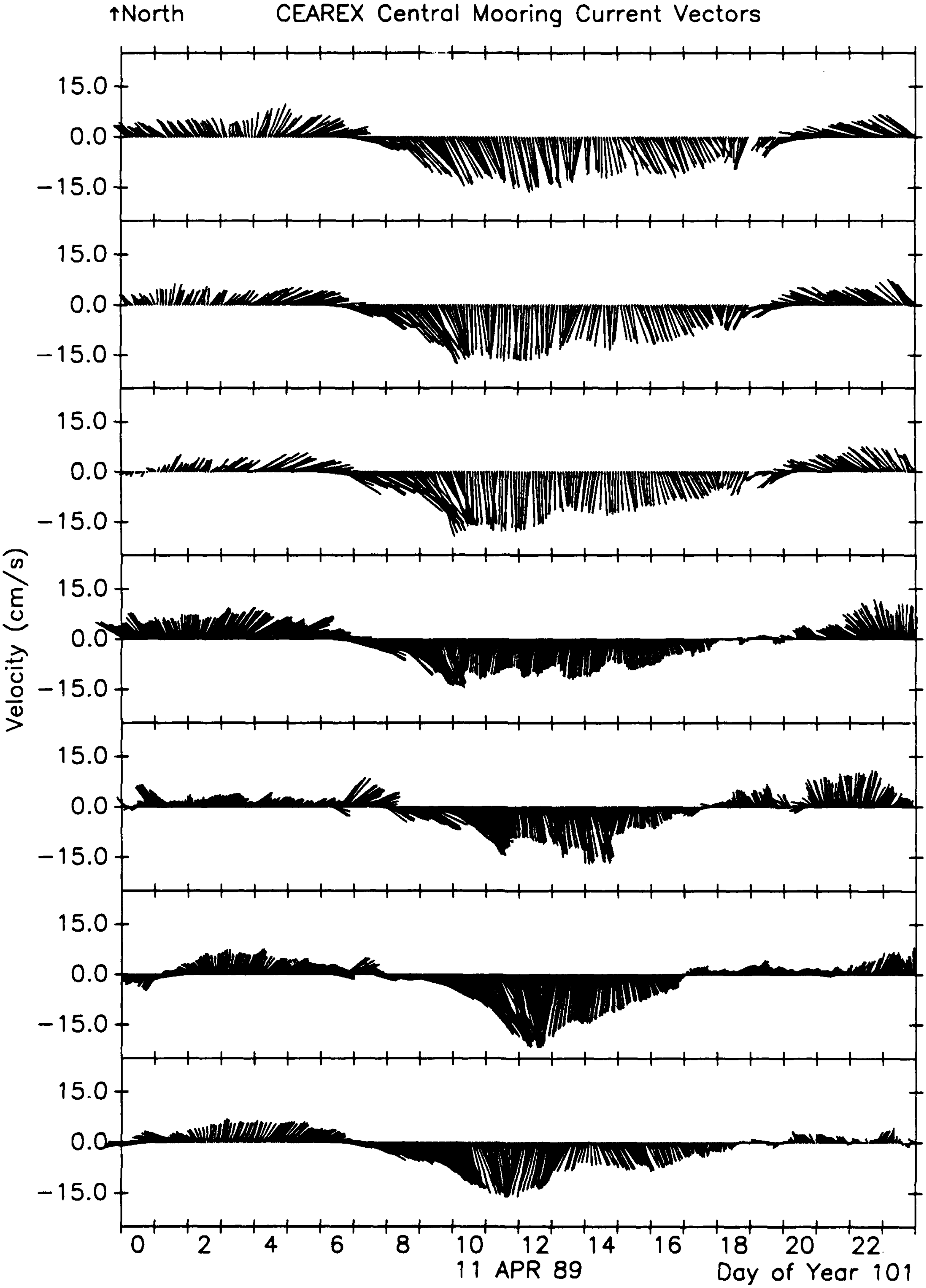

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
6 APR 89
Day of Year 96

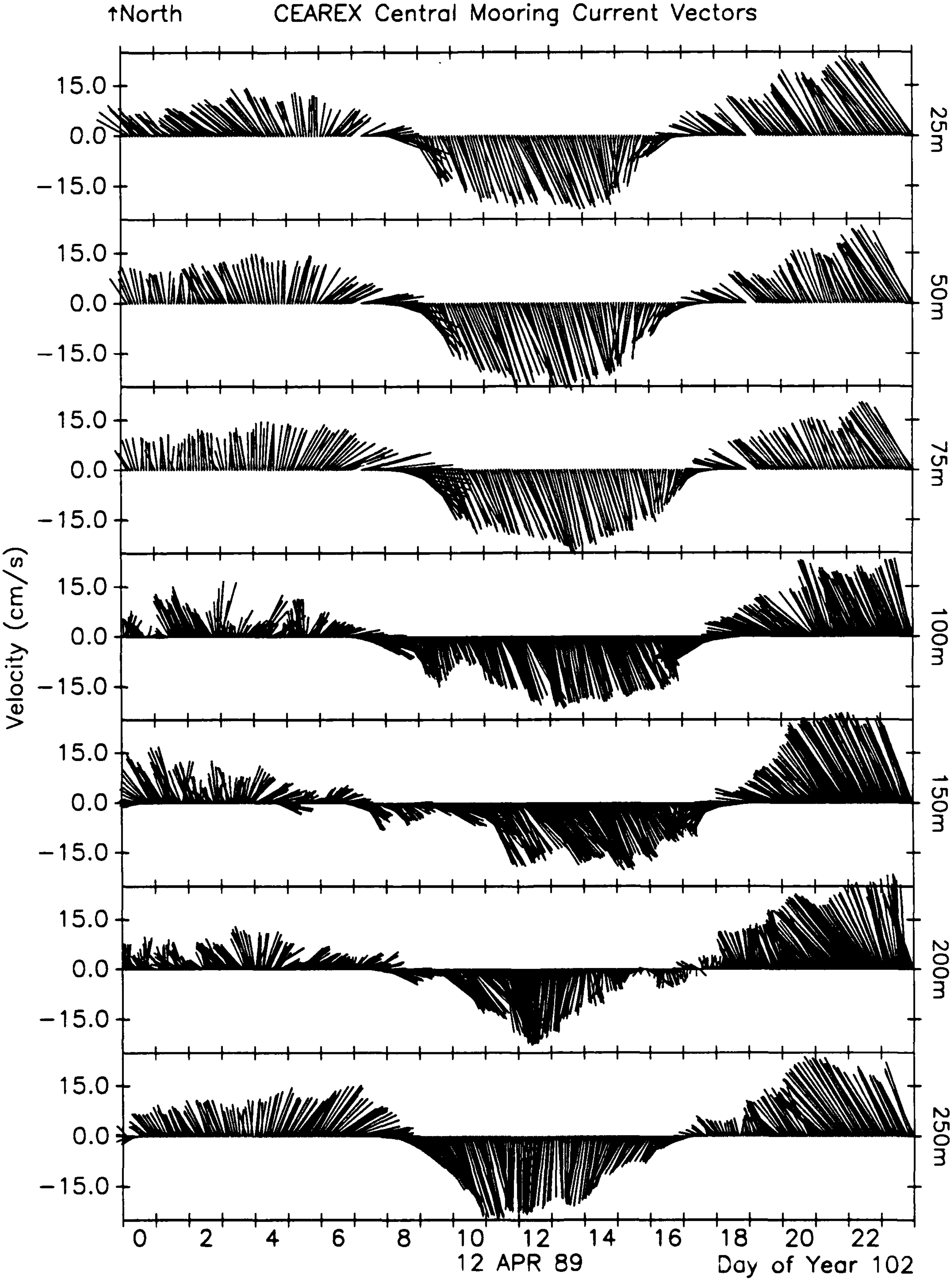

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
7 APR 89
Day of Year 97

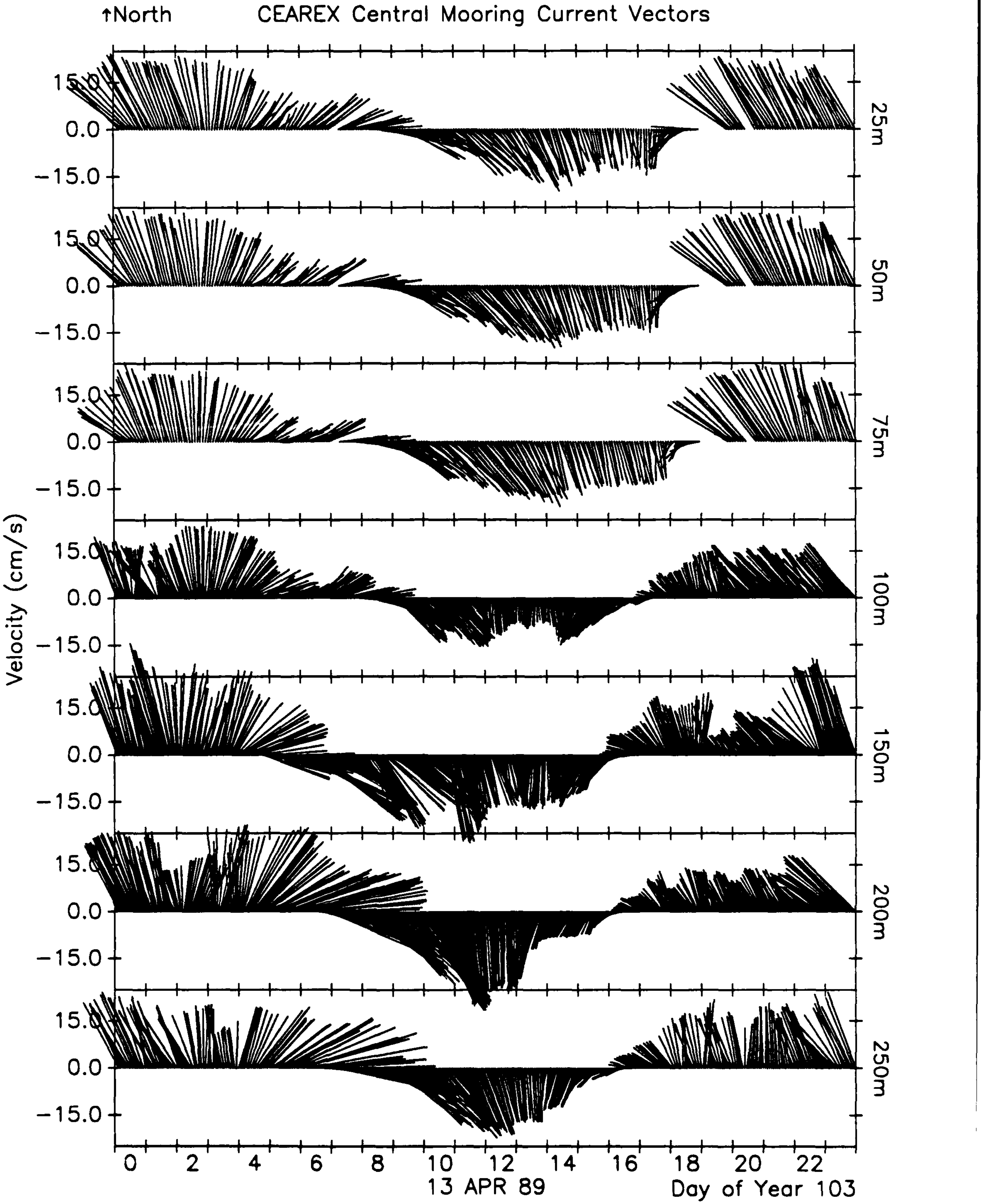

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
8 APR 89
Day of Year 98

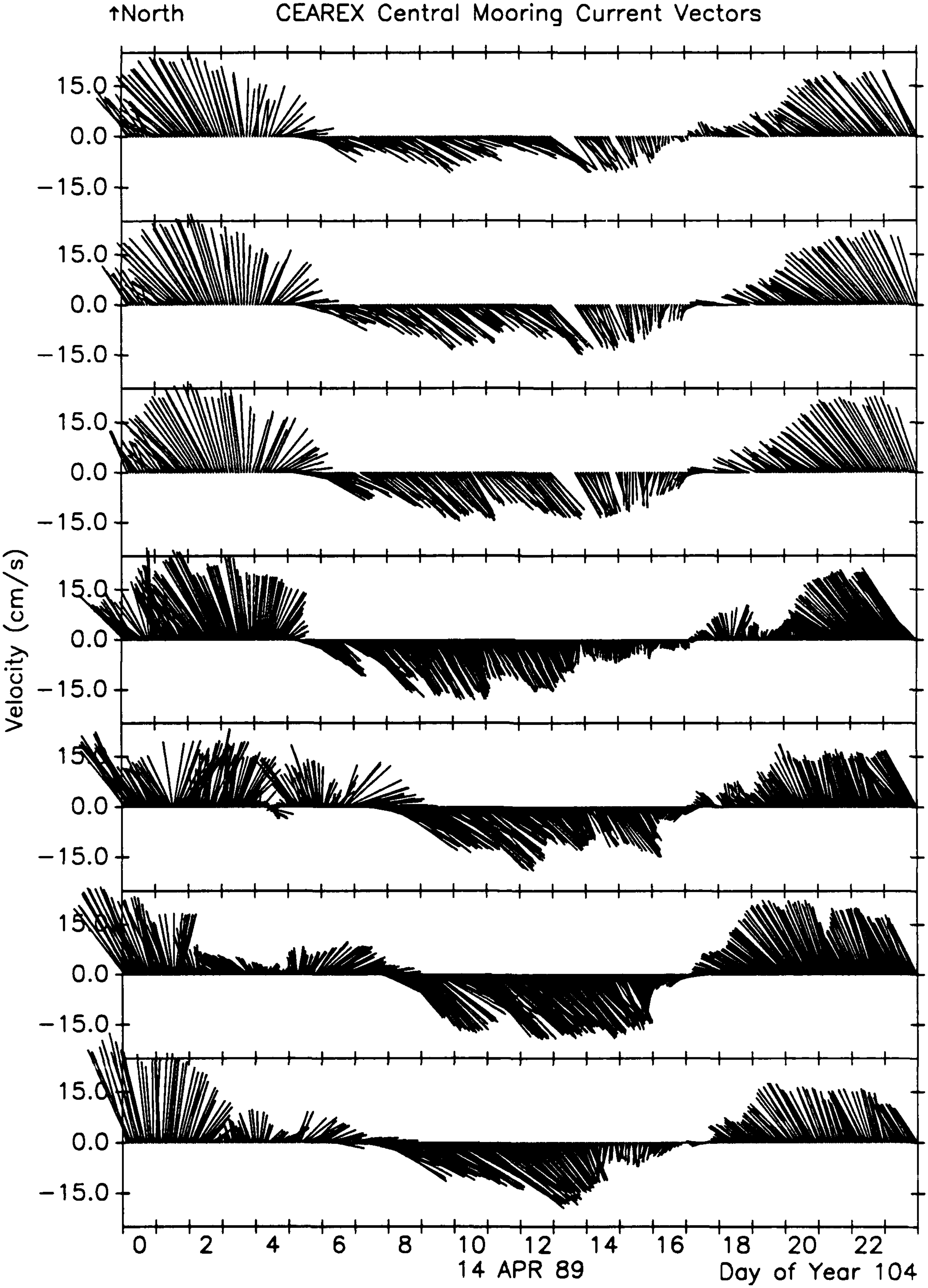

↑North
CEAREX Central Mooring Current Vectors
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
9 APR 89
Day of Year 99

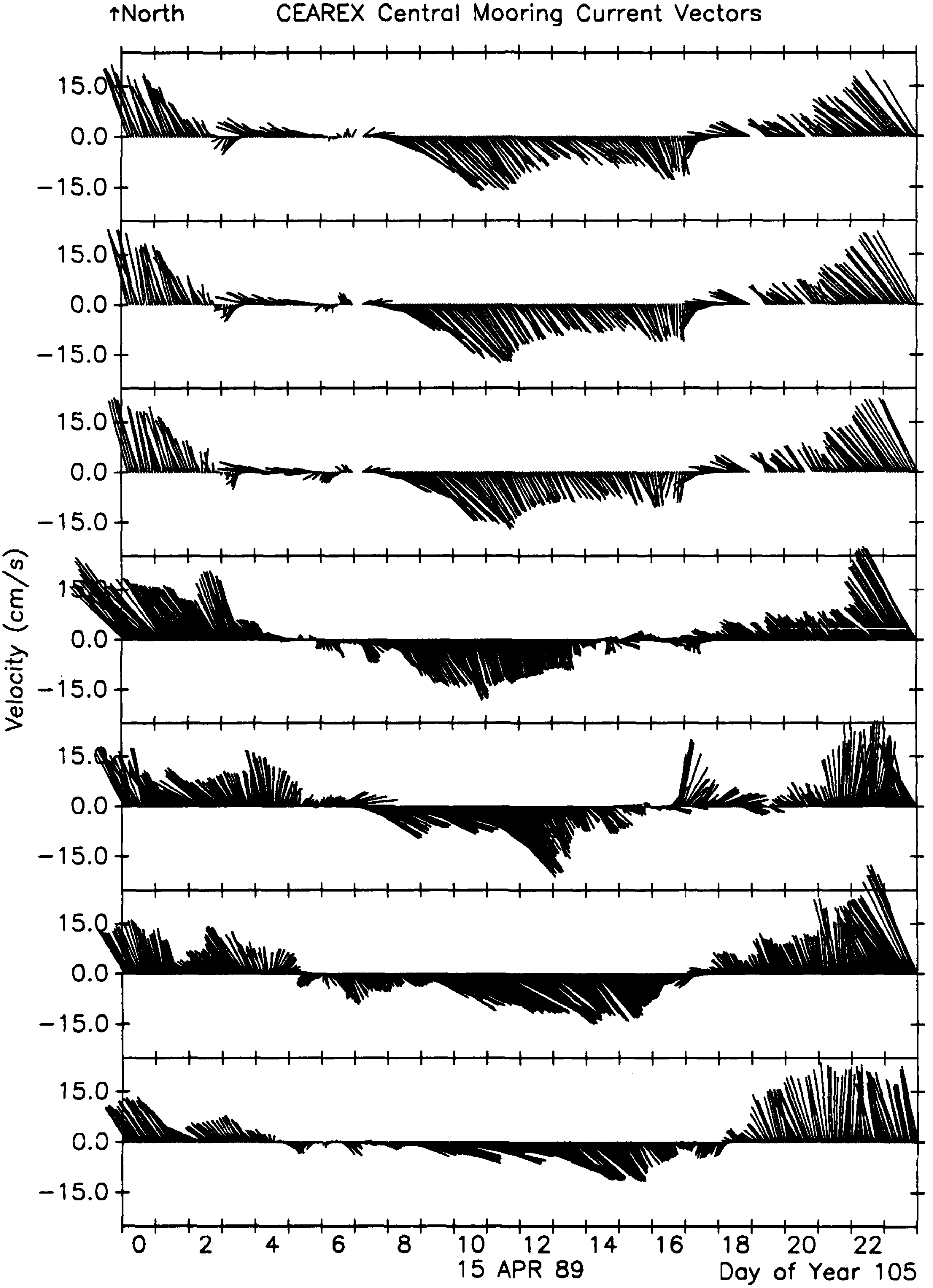

↑North
CEAREX Central Mooring Current Vectors
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
10 APR 89
Day of Year 100

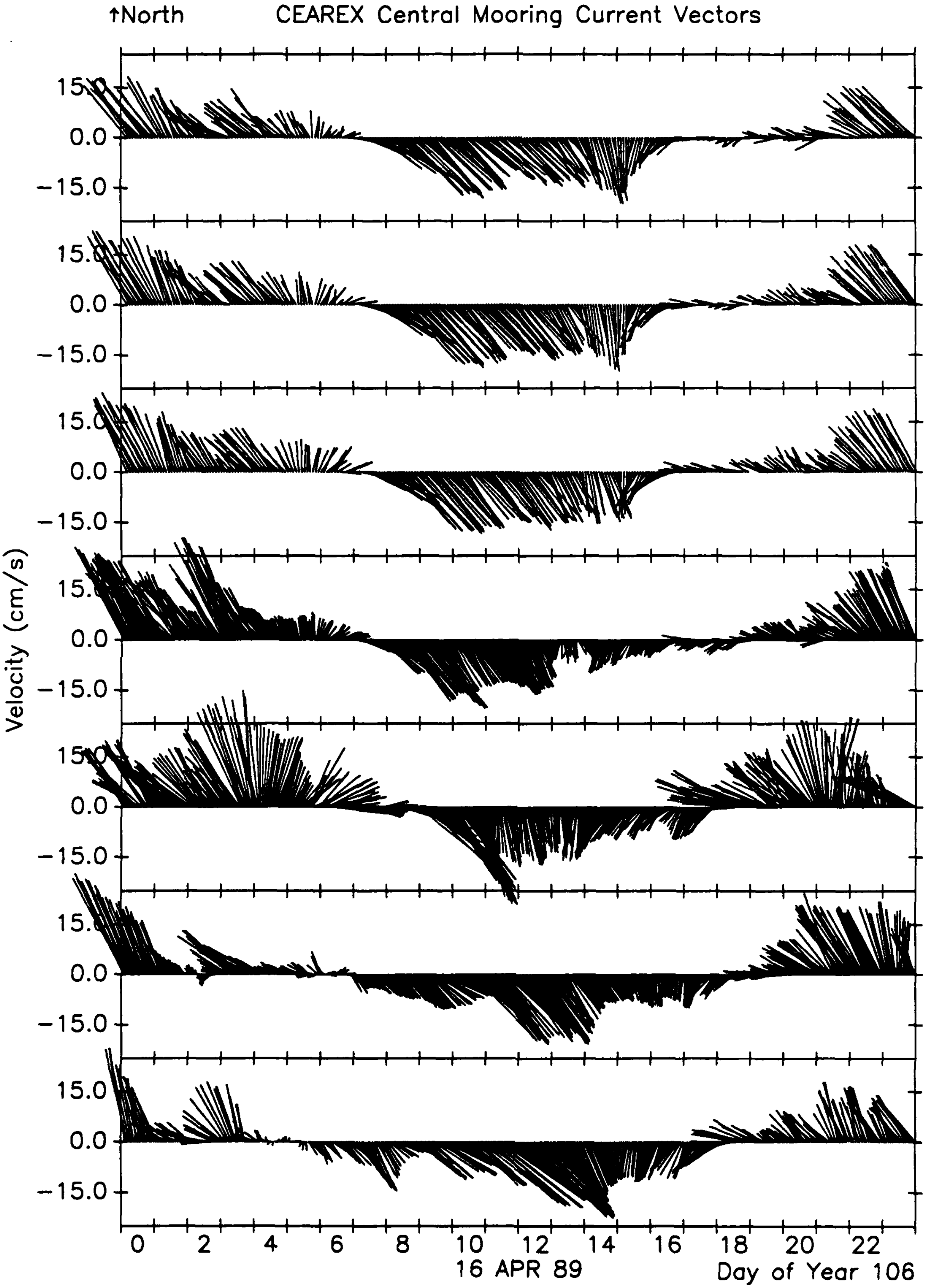

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
11 APR 89
Day of Year 101

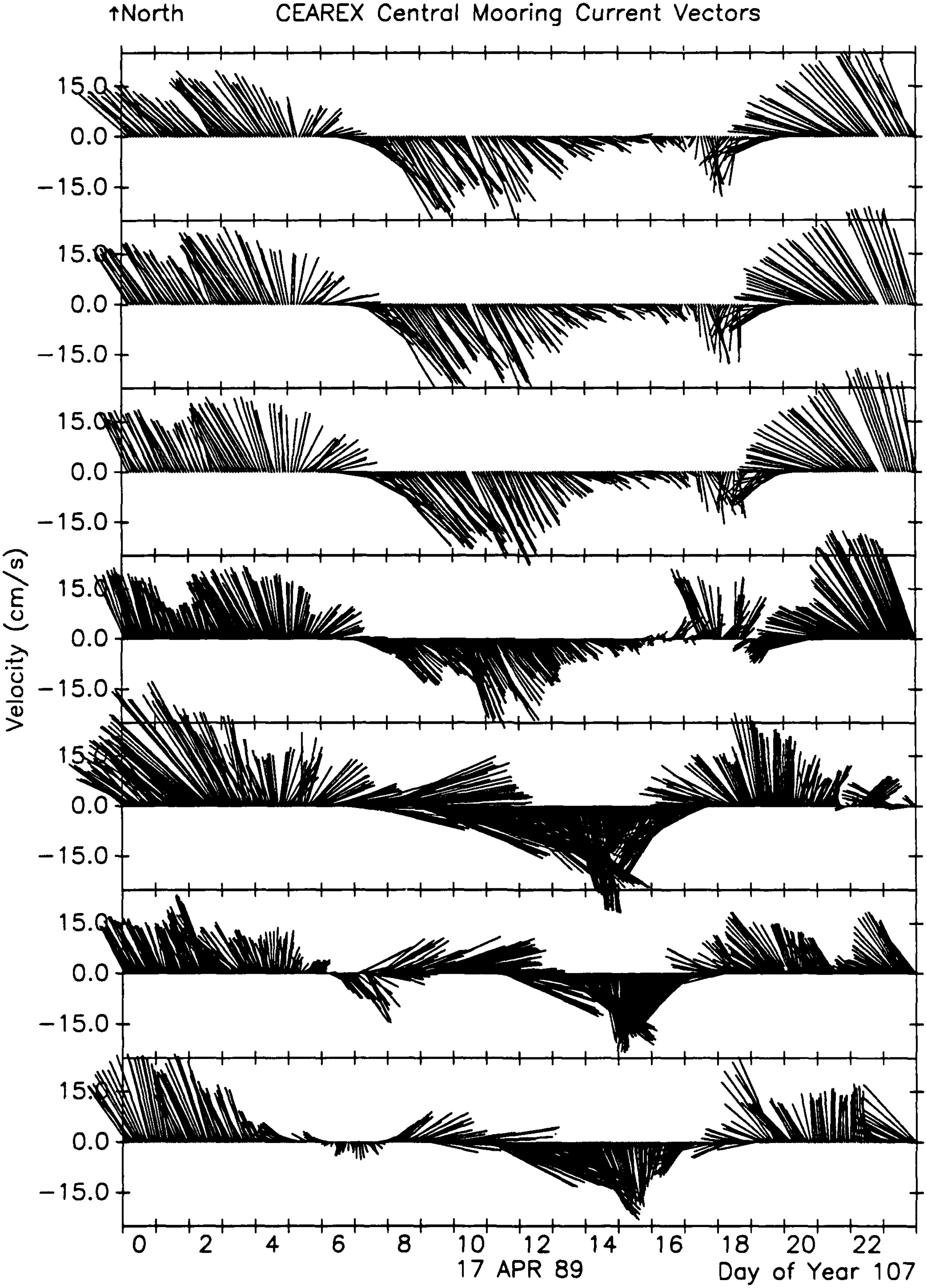

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
12 APR 89
Day of Year 102

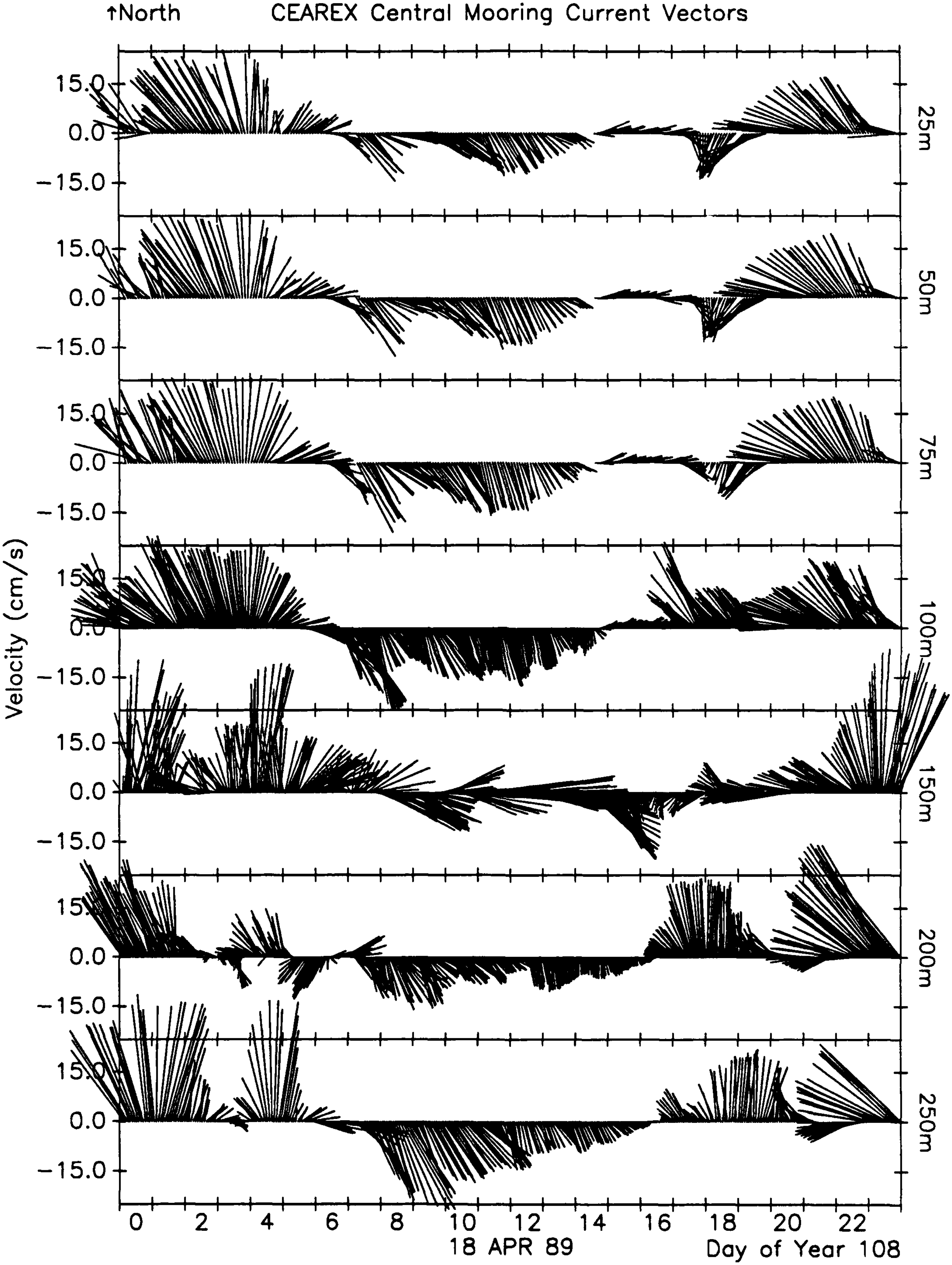

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
13 APR 89
Day of Year 103

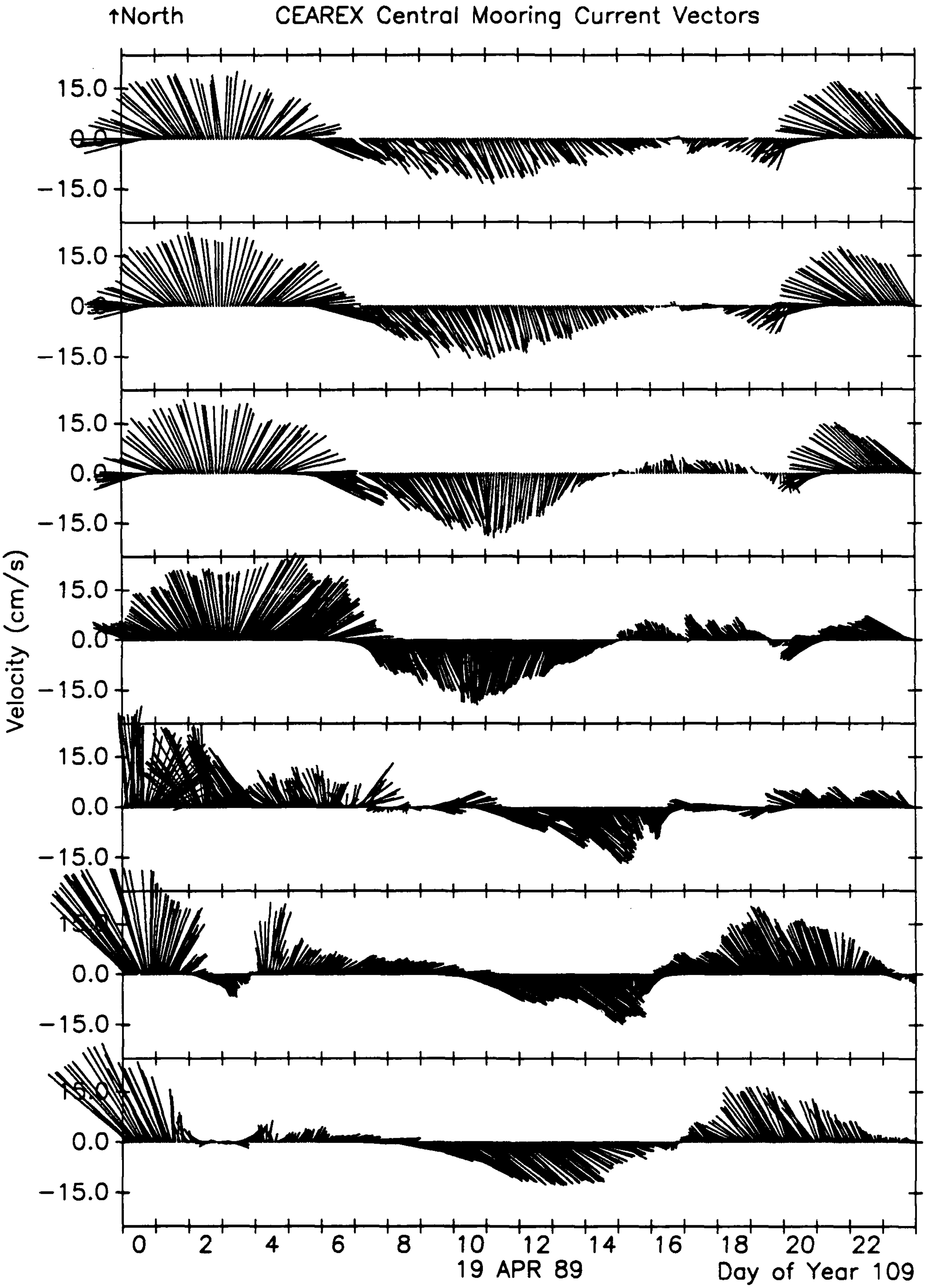

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
14 APR 89
Day of Year 104

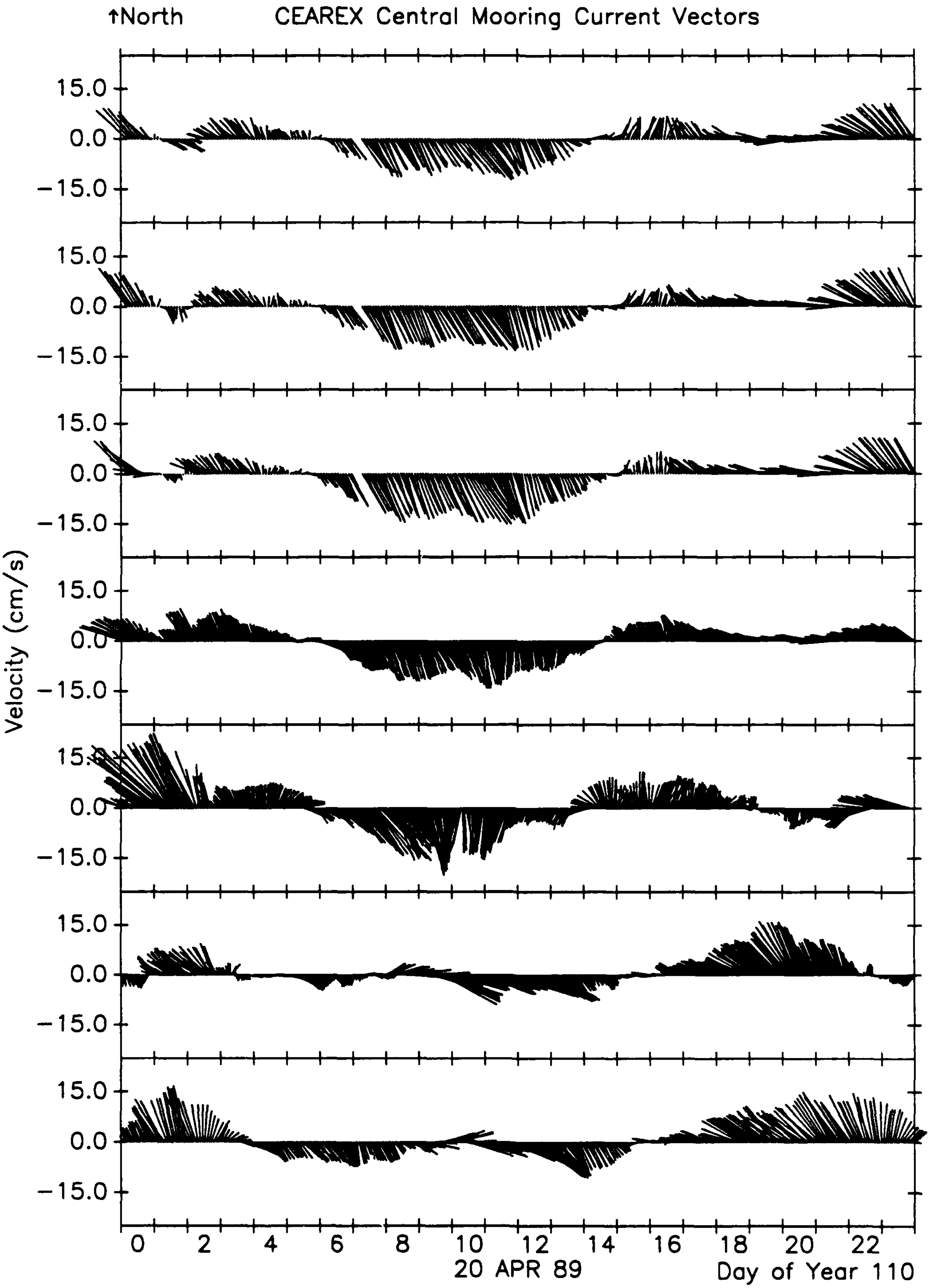

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
15 APR 89
Day of Year 105

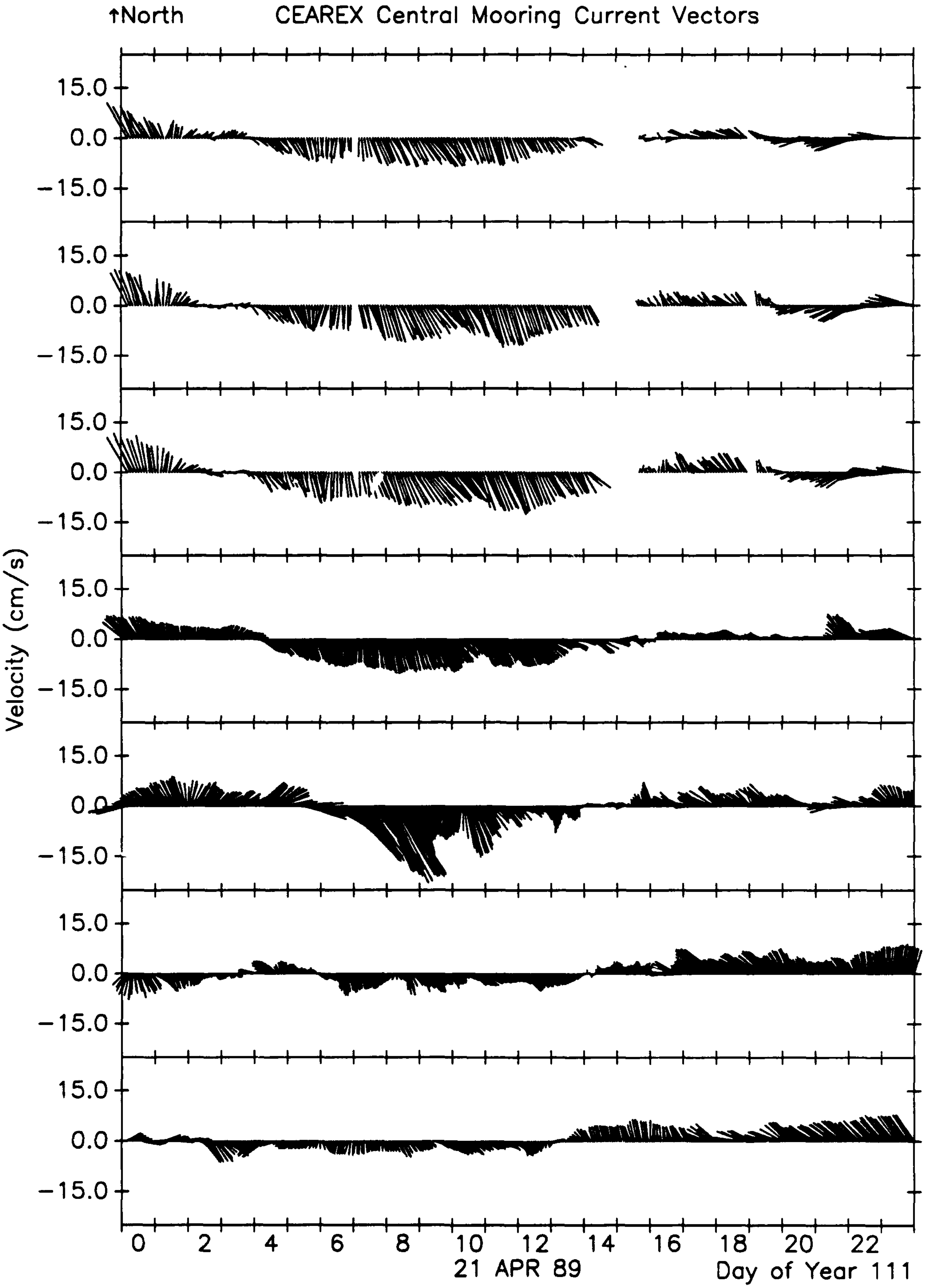

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
16 APR 89
Day of Year 106

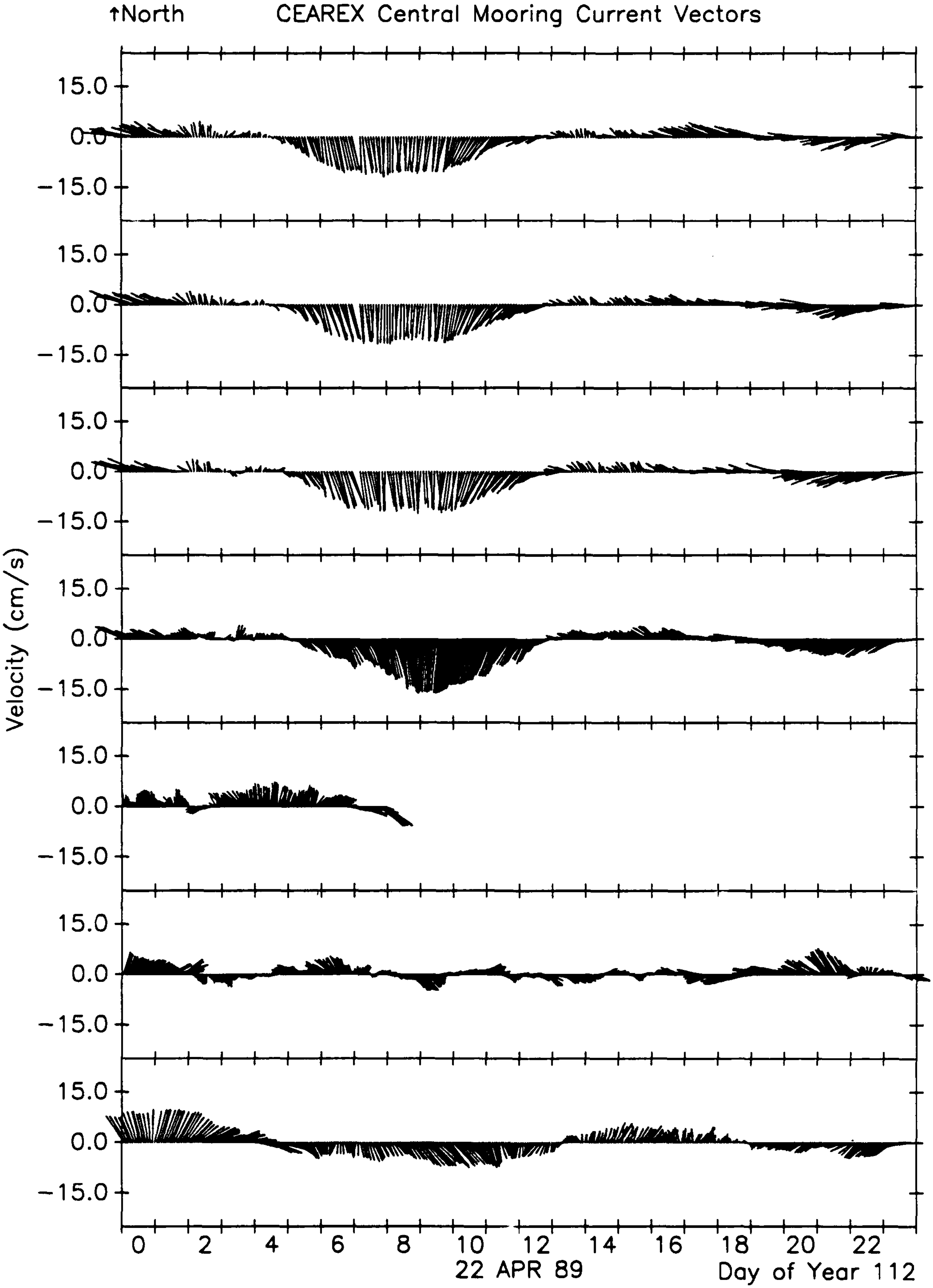

↑North
CEAREX Central Mooring Current Vectors
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
17 APR 89
Day of Year 107

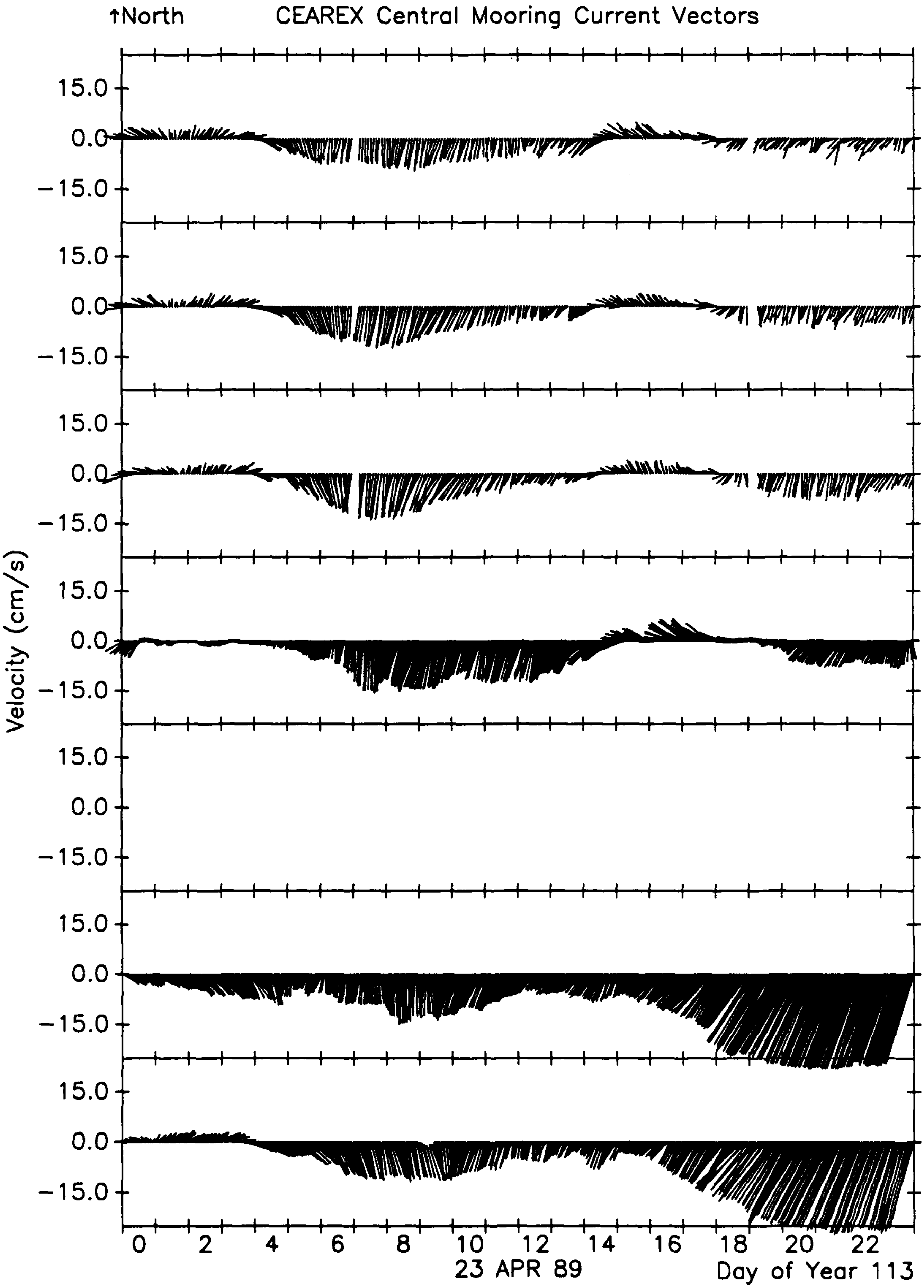

↑North
CEAREX Central Mooring Current Vectors
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
18 APR 89
Day of Year 108

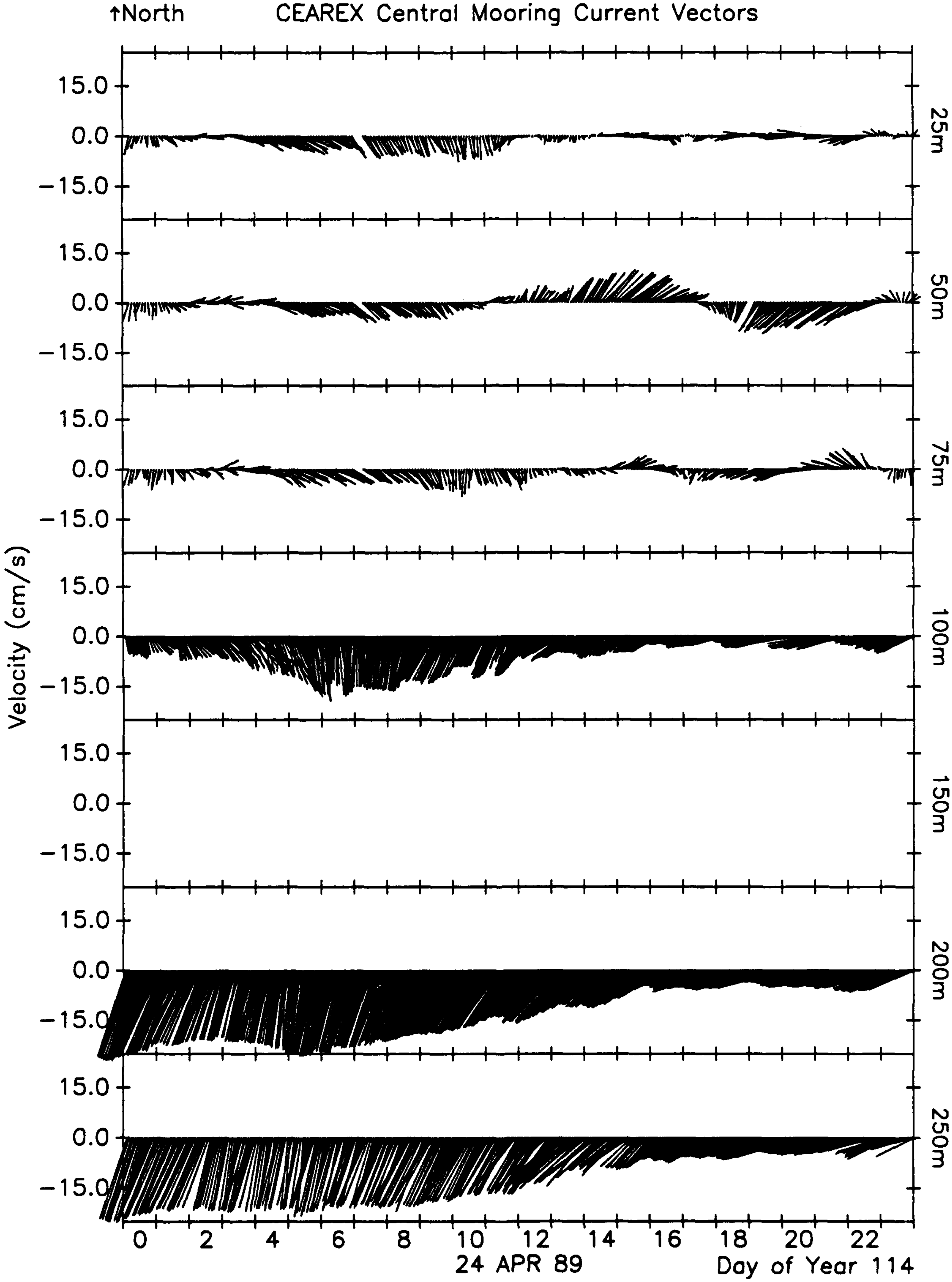

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
19 APR 89
Day of Year 109

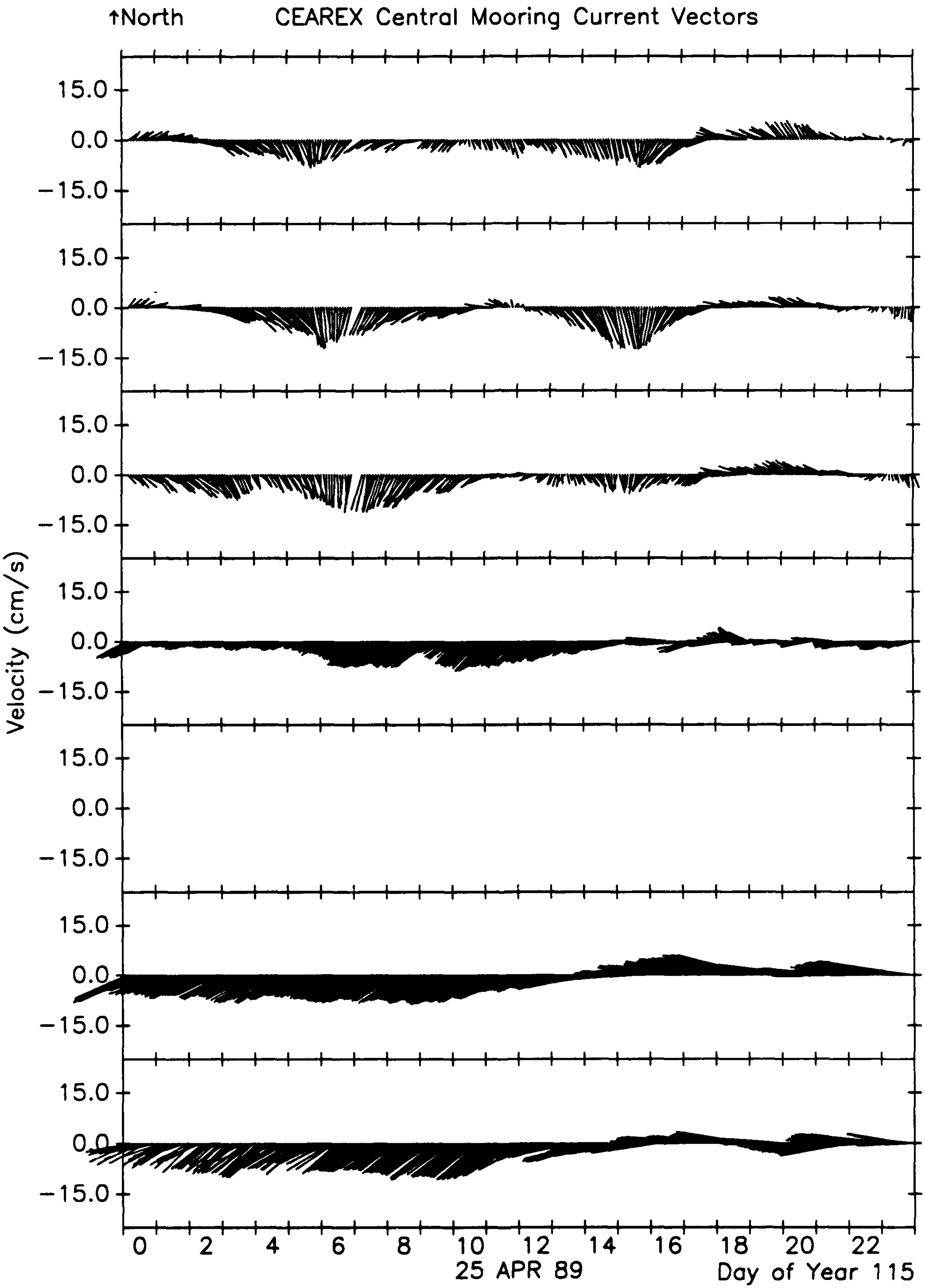

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
20 APR 89
Day of Year 110

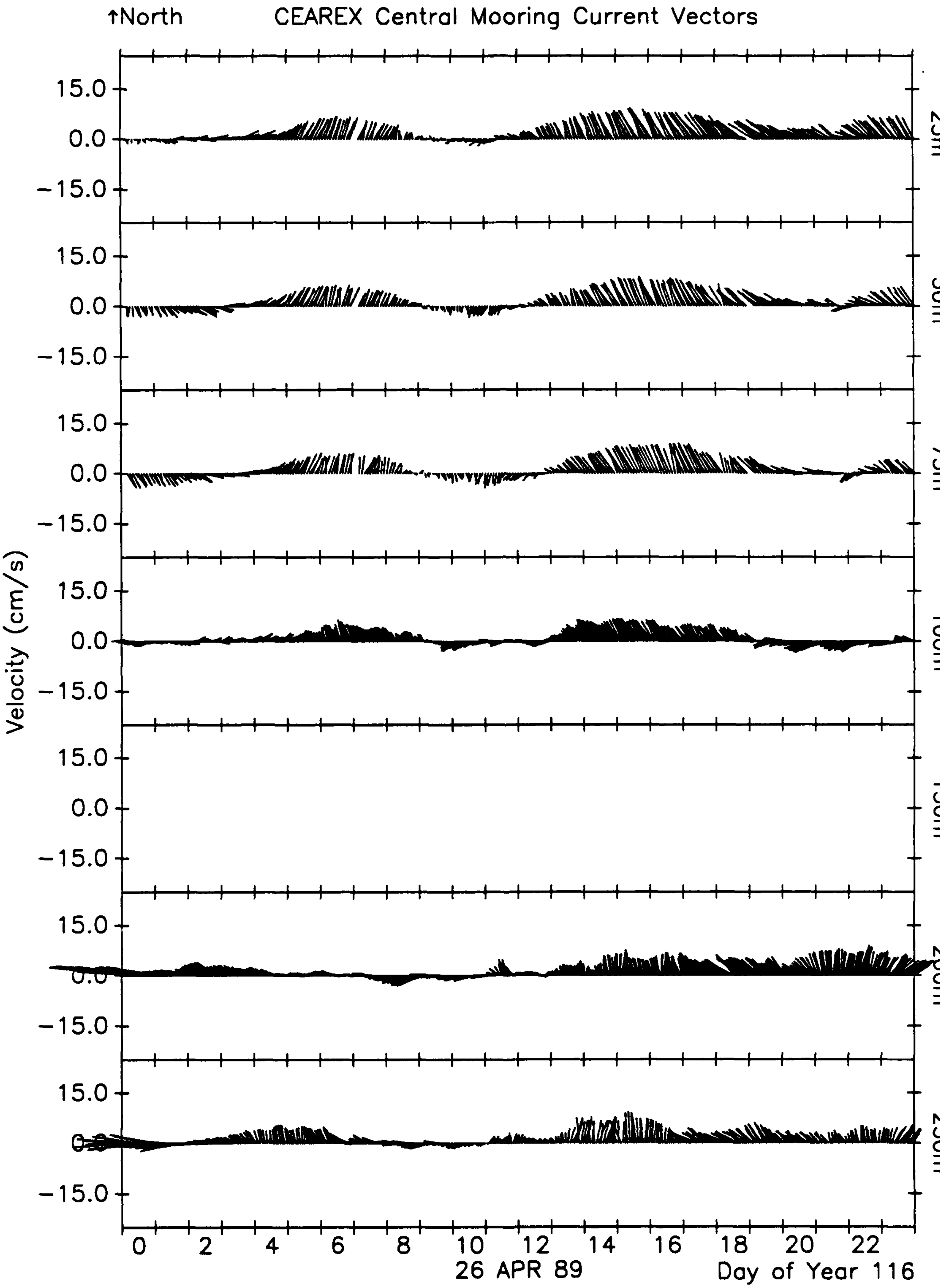

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
21 APR 89
Day of Year 111

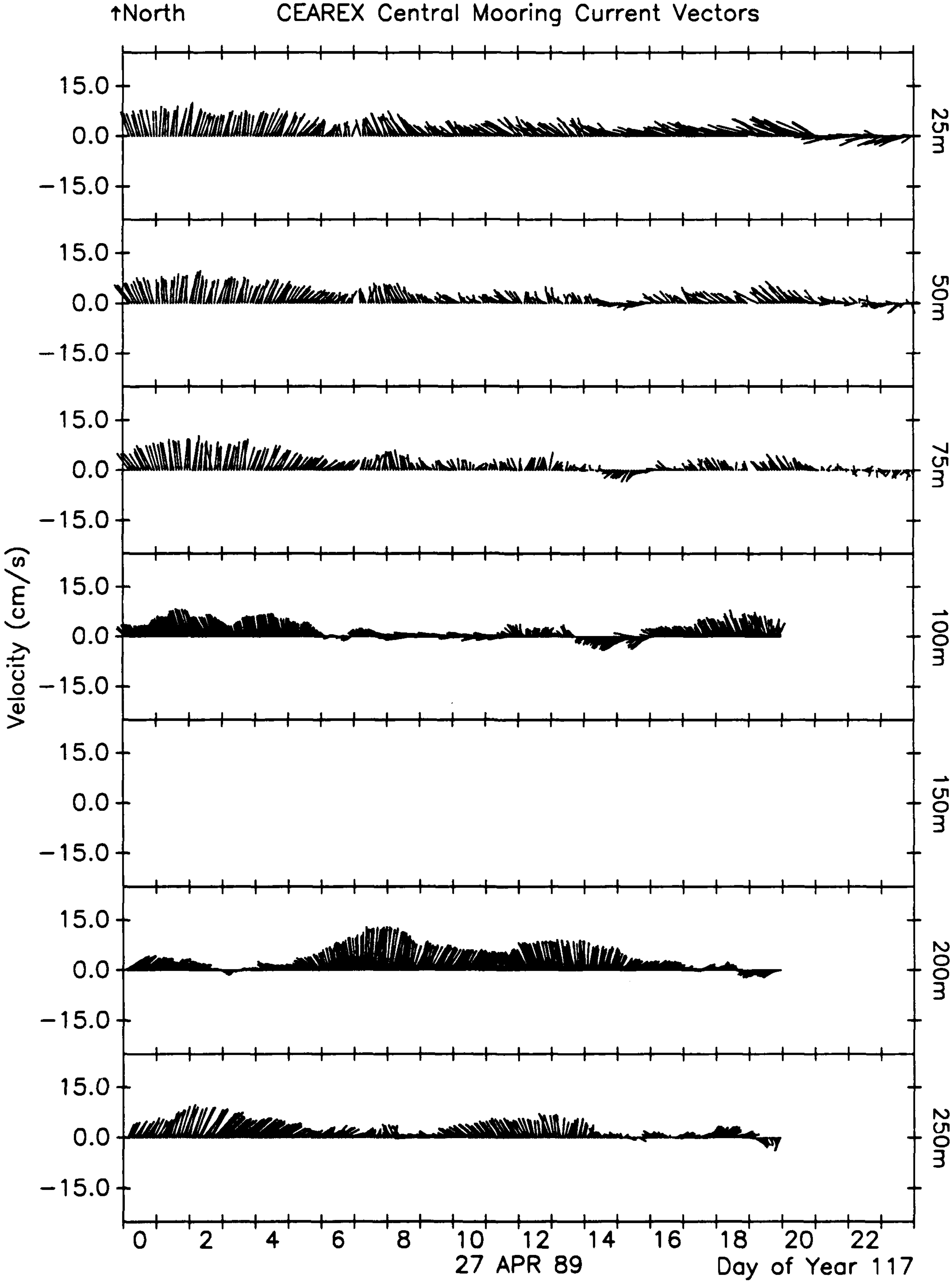

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
22 APR 89
Day of Year 112


↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
23 APR 89
Day of Year 113

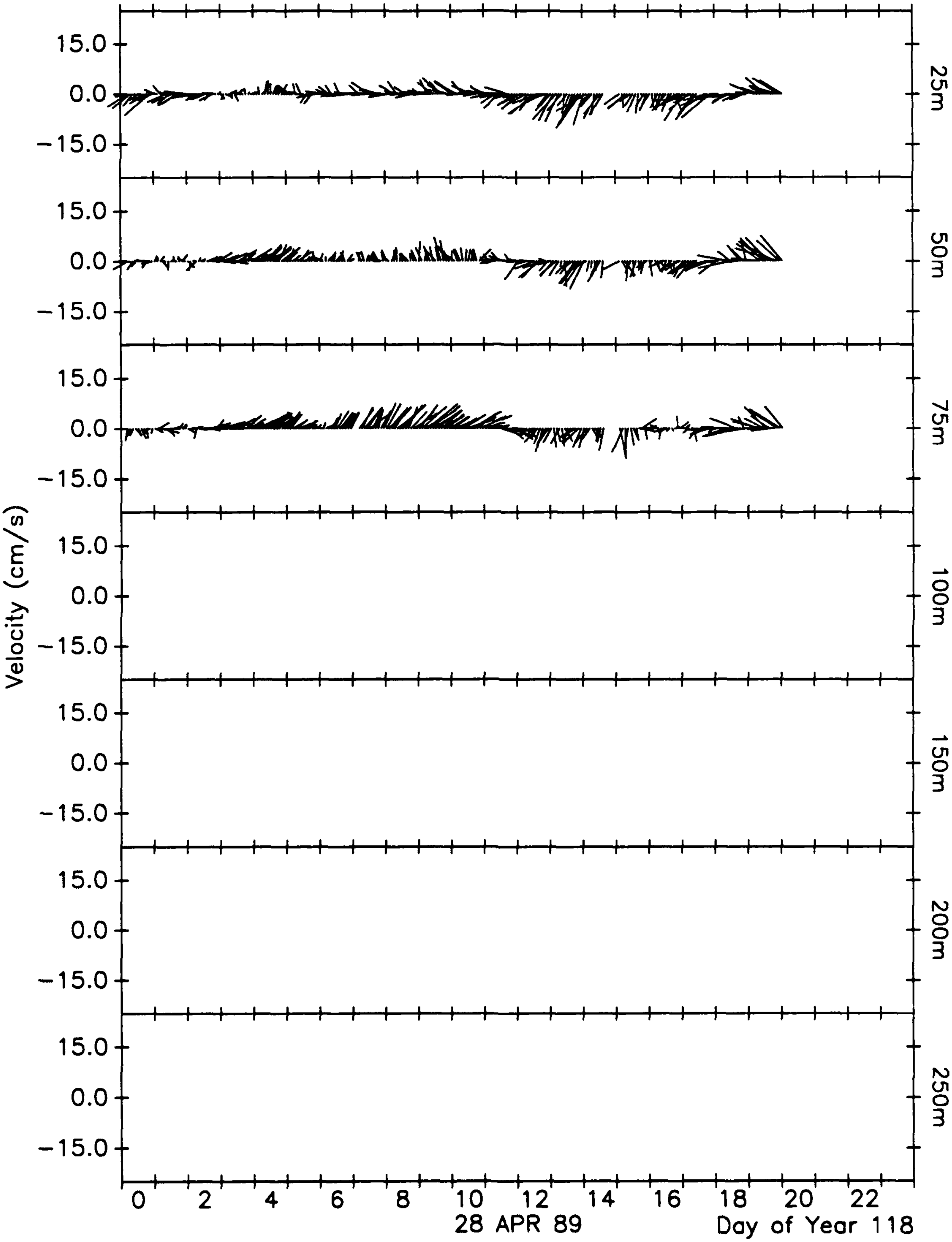

↑North
CEAREX Central Mooring Current Vectors
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0 2 4 6 8 10 12 14 16 18 20 22
24 APR 89
Day of Year 114


↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
25 APR 89
Day of Year 115


↑North
CEAREX Central Mooring Current Vectors
15.0
0.0
−15.0
Velocity (cm/s)
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
26 APR 89
Day of Year 116

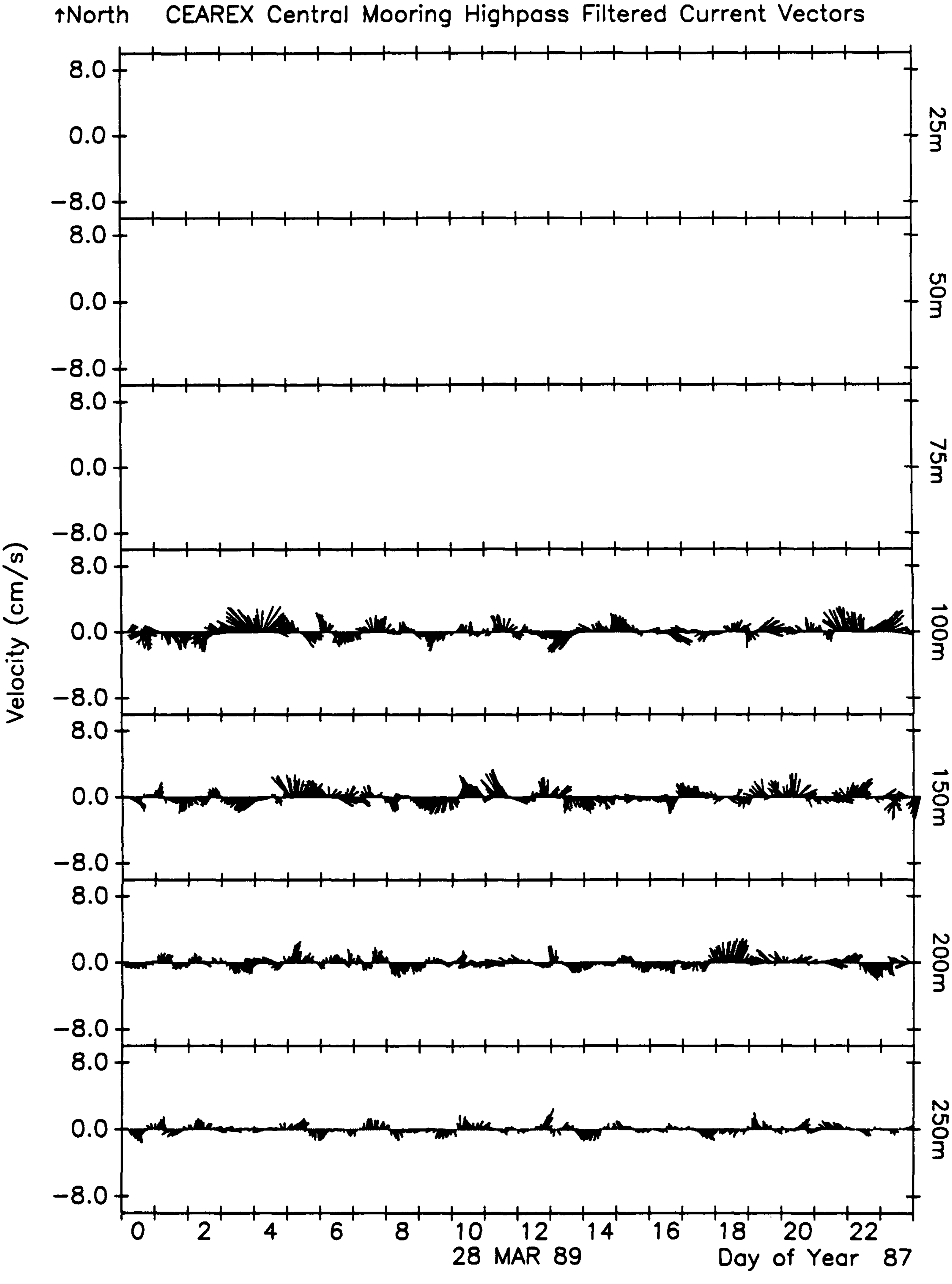

↑North
CEAREX Central Mooring Current Vectors
Velocity (cm/s)
15.0
0.0
−15.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
27 APR 89
Day of Year 117

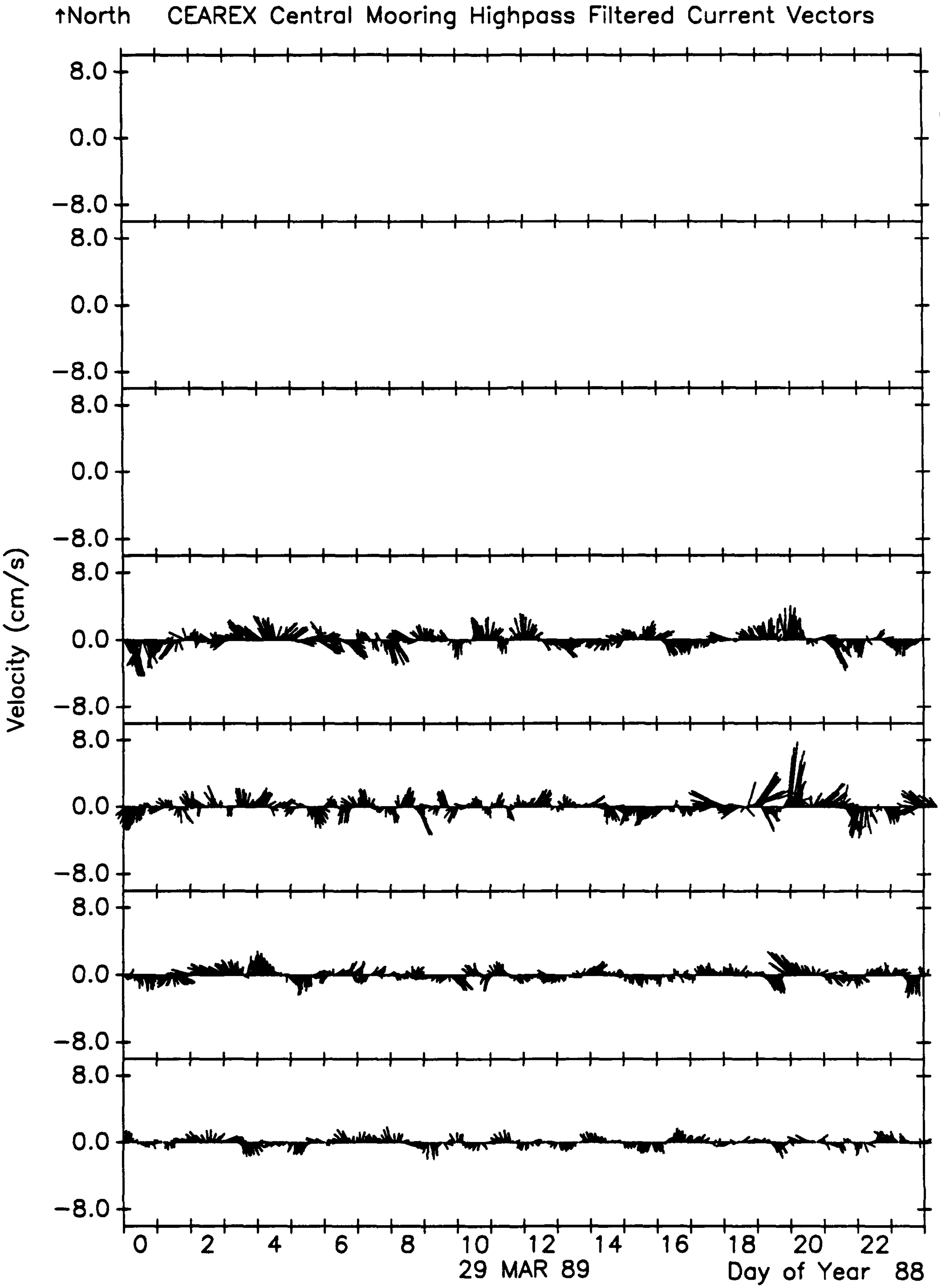
↑North CEAREX Central Mooring Current Vectors

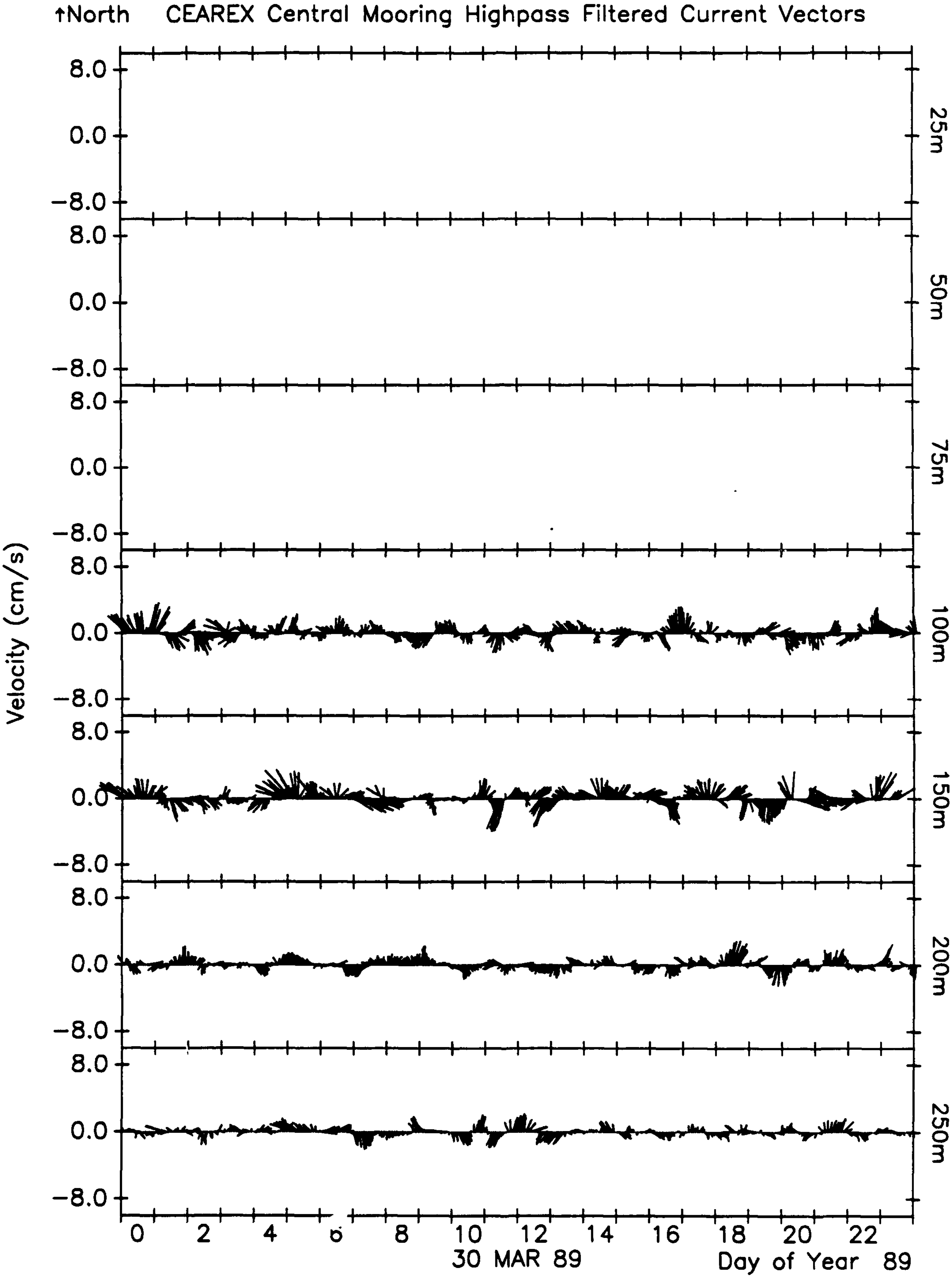


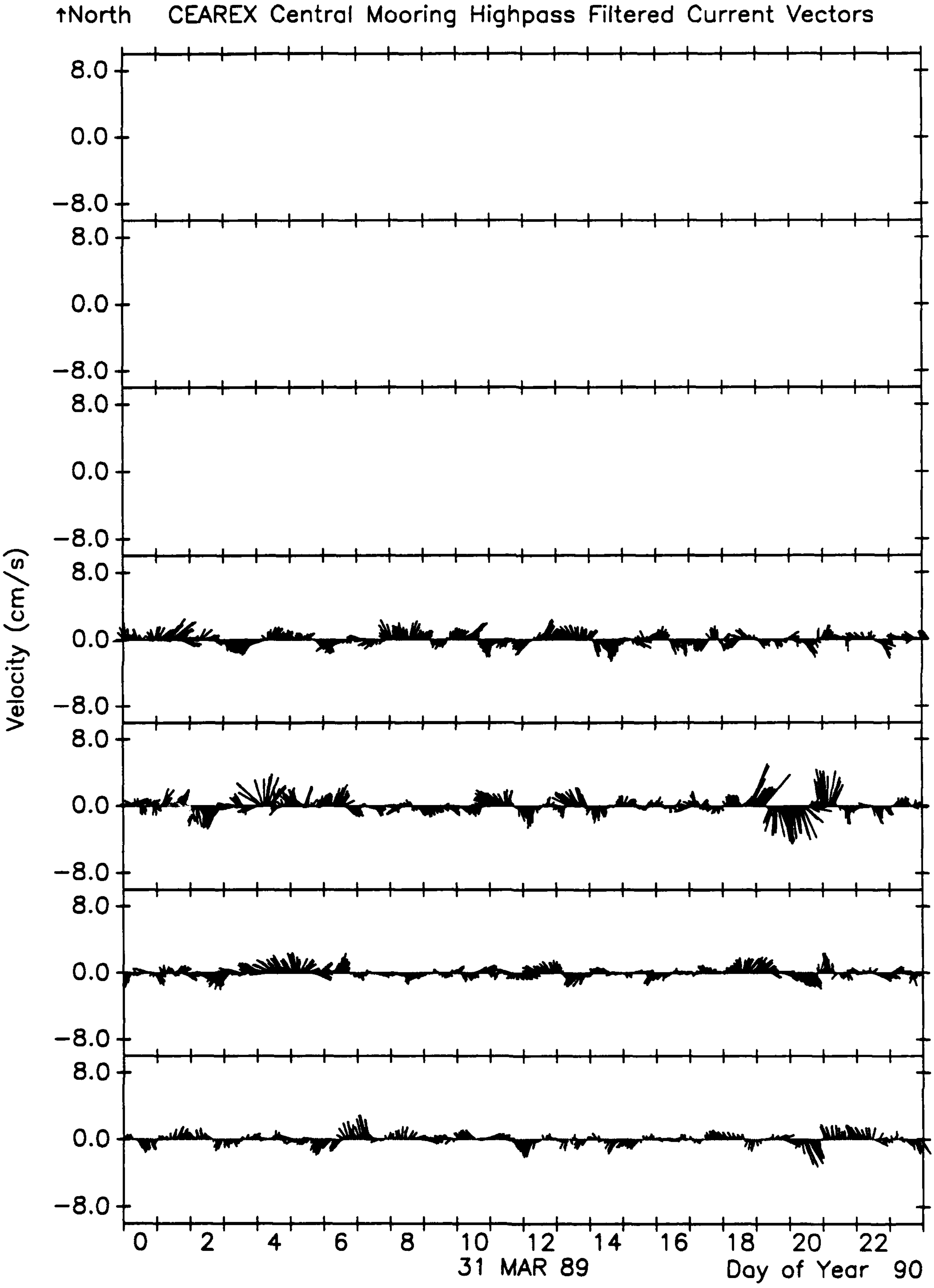
TIME SERIES OF VELOCITY AT CENTRAL SITE: HIGH-PASS FILTERED

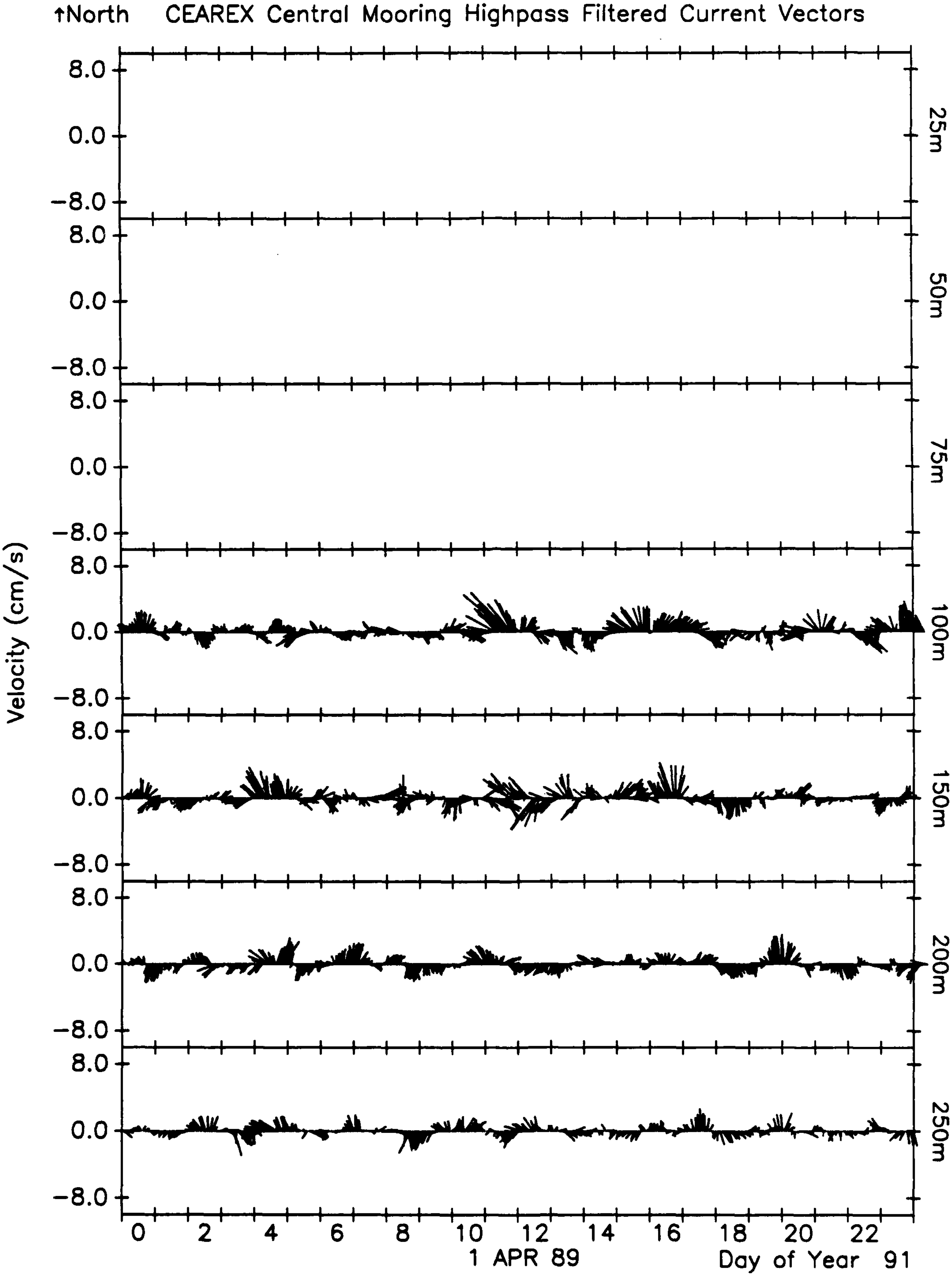
On the following 32 pages are observations of velocity from the Central site at depths of 25, 50, 75, 100, 150, 200 and 250 m. The data above 100 m is from the ADCP; the records at 100 m and deeper are from S-4 current meters. A high-pass filter with a 6 hour cutoff has been applied. Note: absolute velocities are presented after the start of April 4; relative velocities are shown before. (See Tables 1 and 2.)


↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
28 MAR 89
Day of Year 87

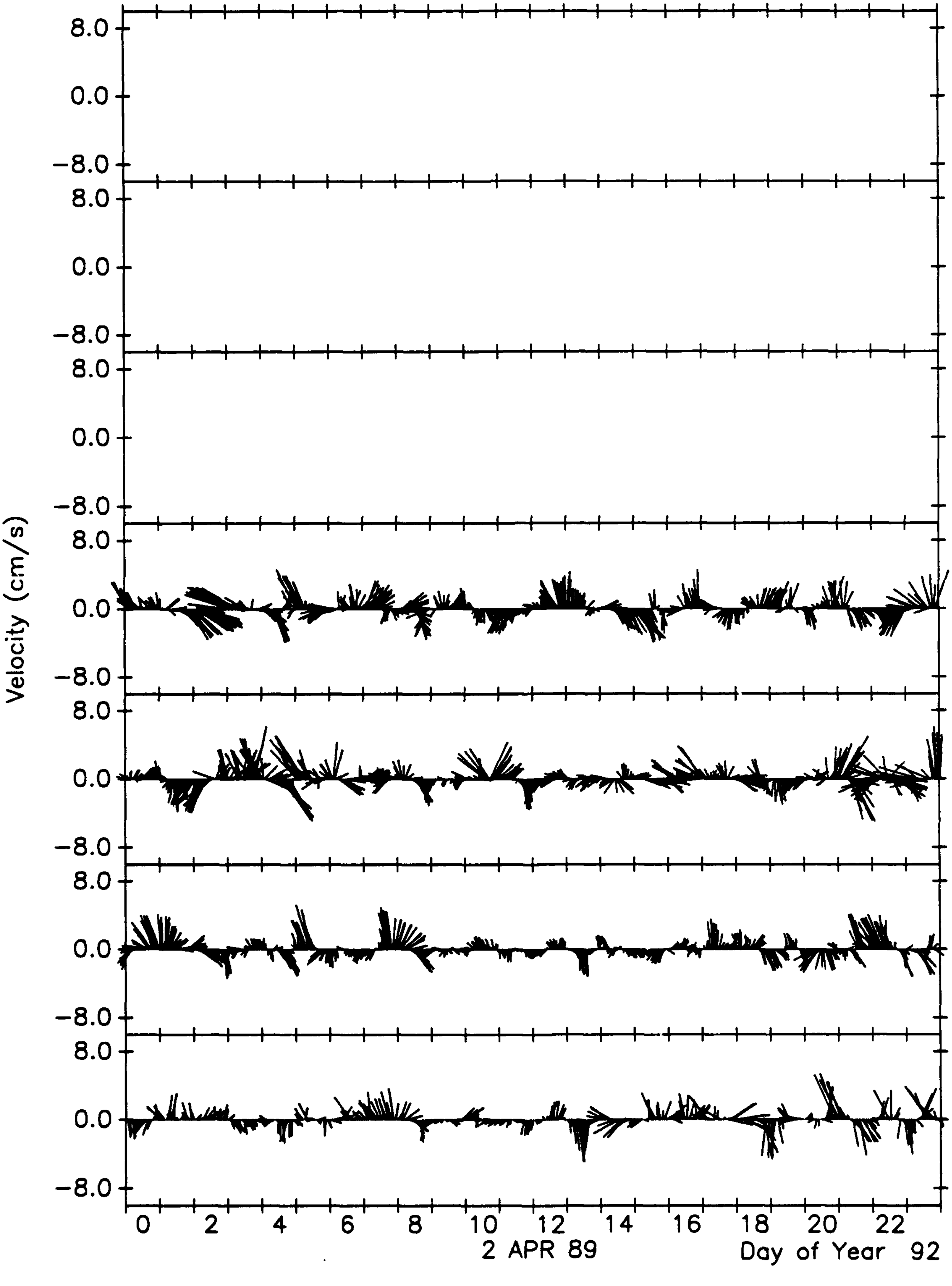

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
29 MAR 89
Day of Year 88

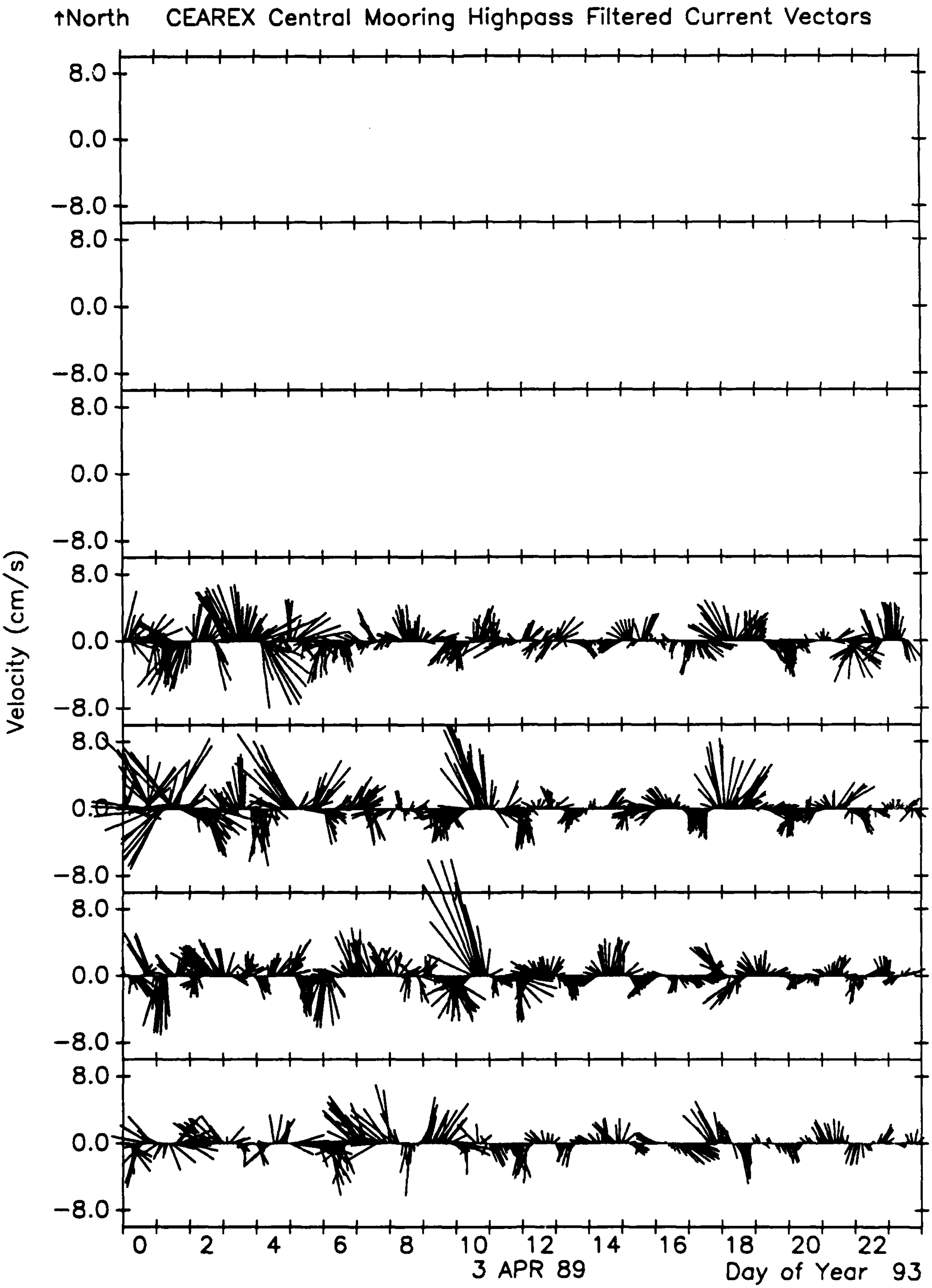

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
30 MAR 89
Day of Year 89

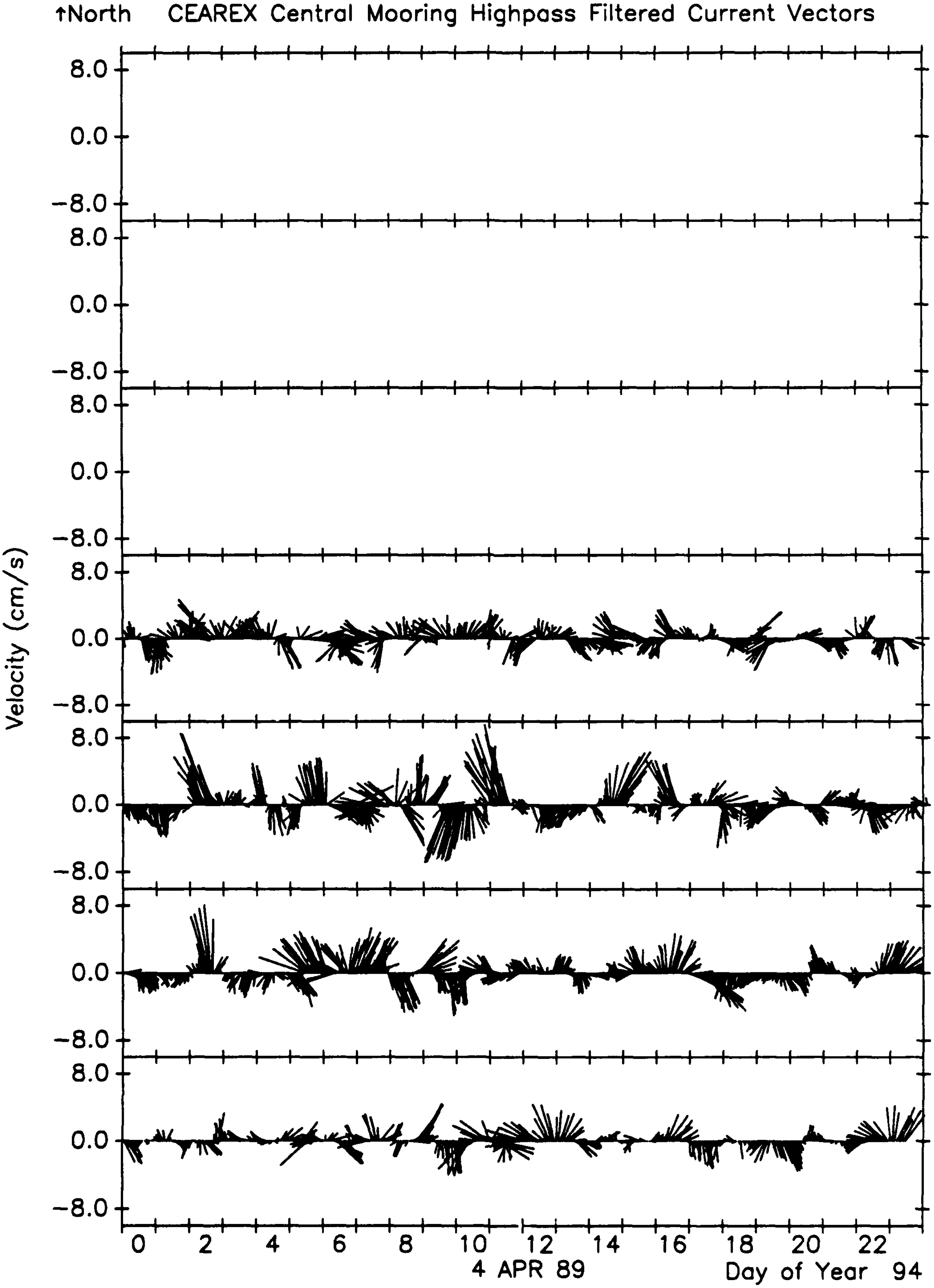

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
31 MAR 89
Day of Year 90


↑North CEAREX Central Mooring Highpass Filtered Current Vectors
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
1 APR 89
Day of Year 91

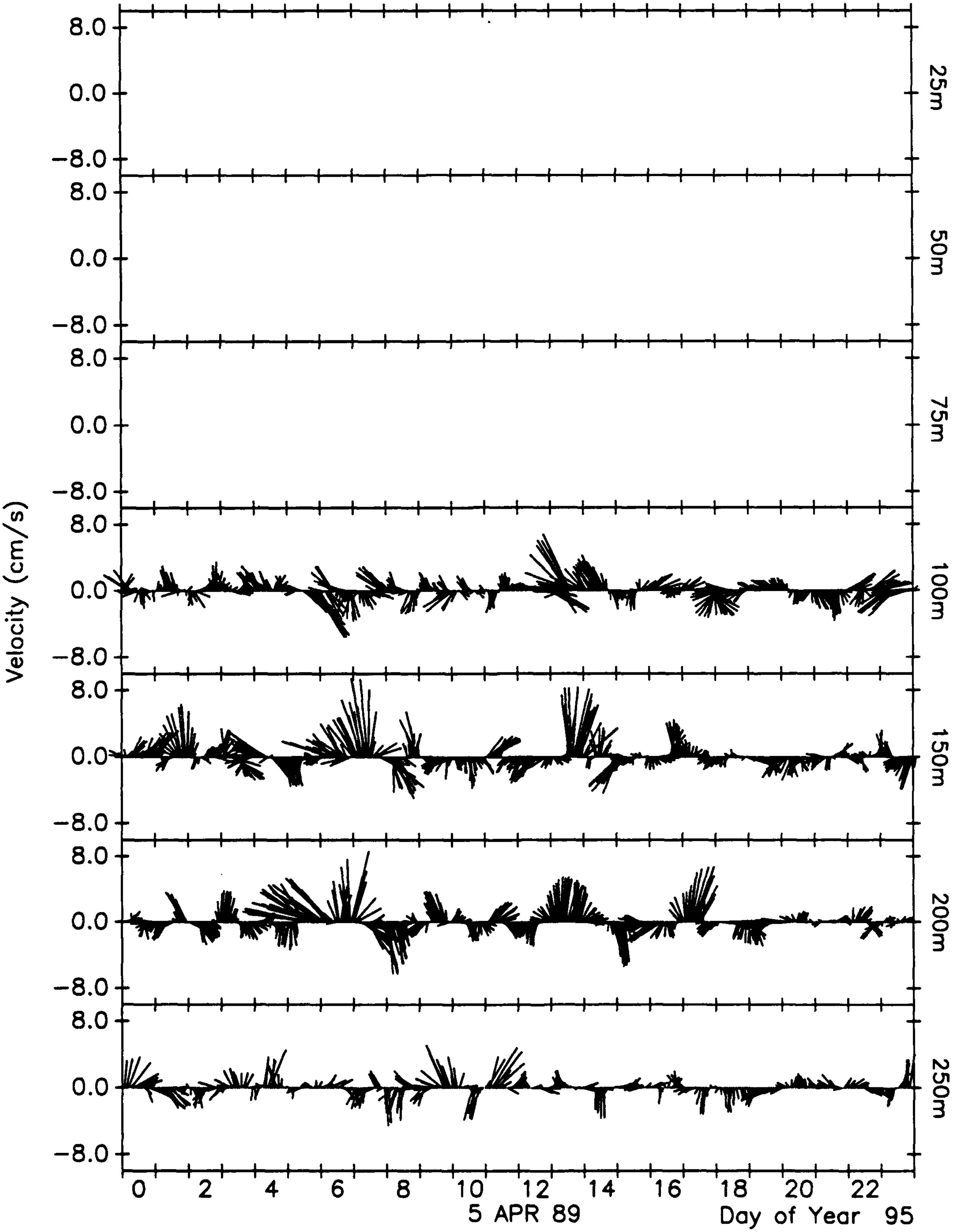
↑North CEAREX Central Mooring Highpass Filtered Current Vectors

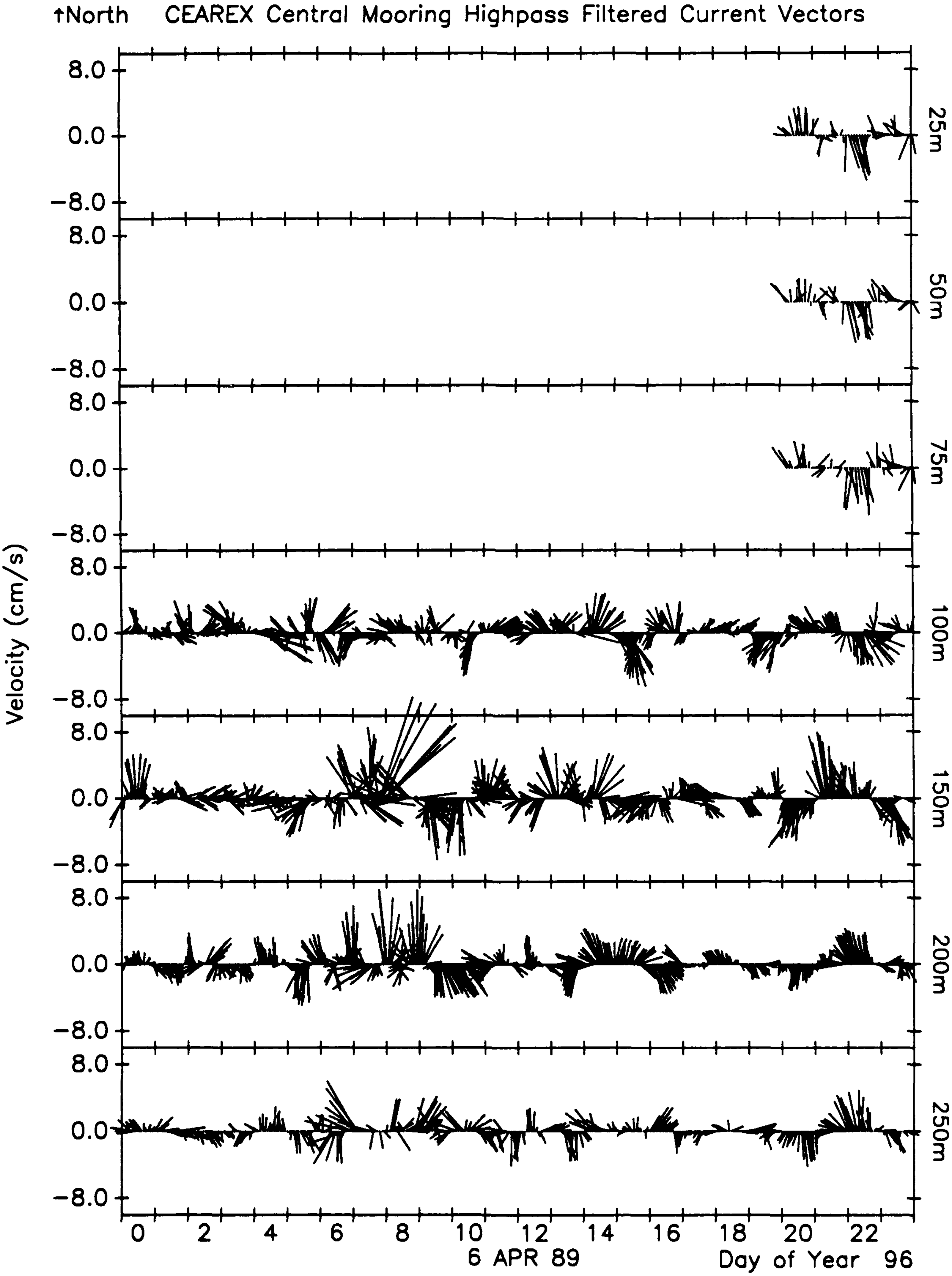


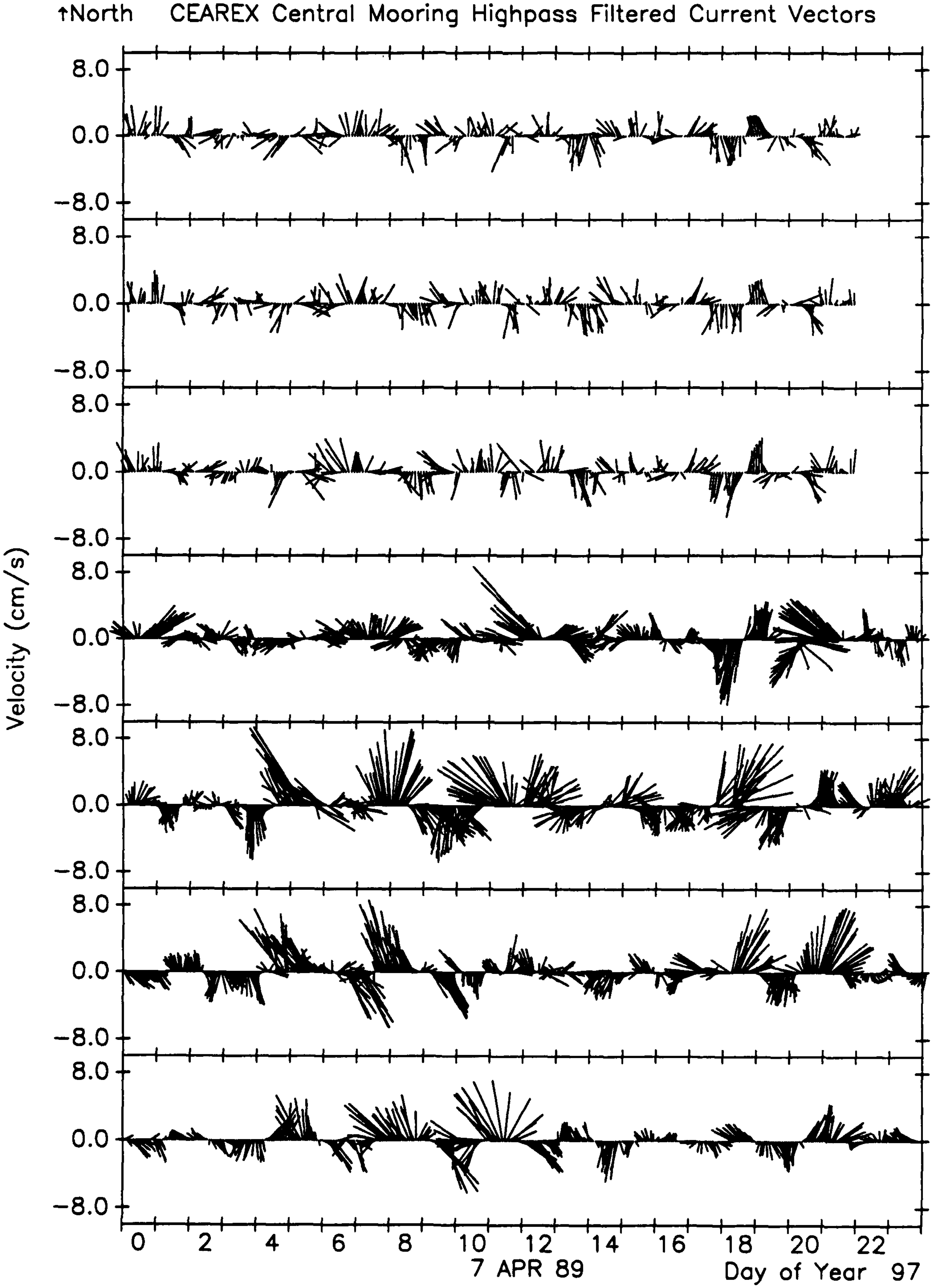

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
3 APR 89
Day of Year 93

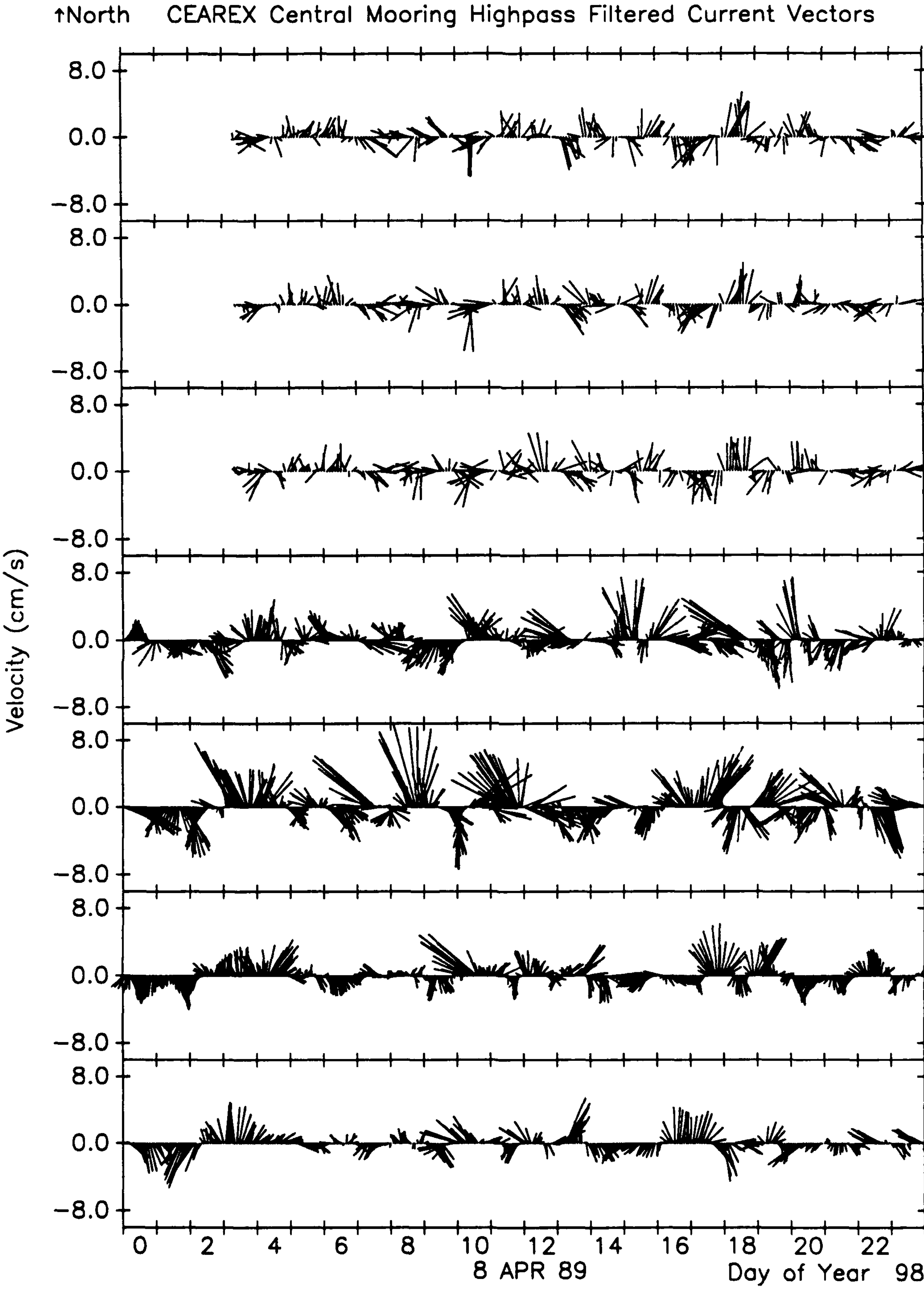

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
4 APR 89
Day of Year 94

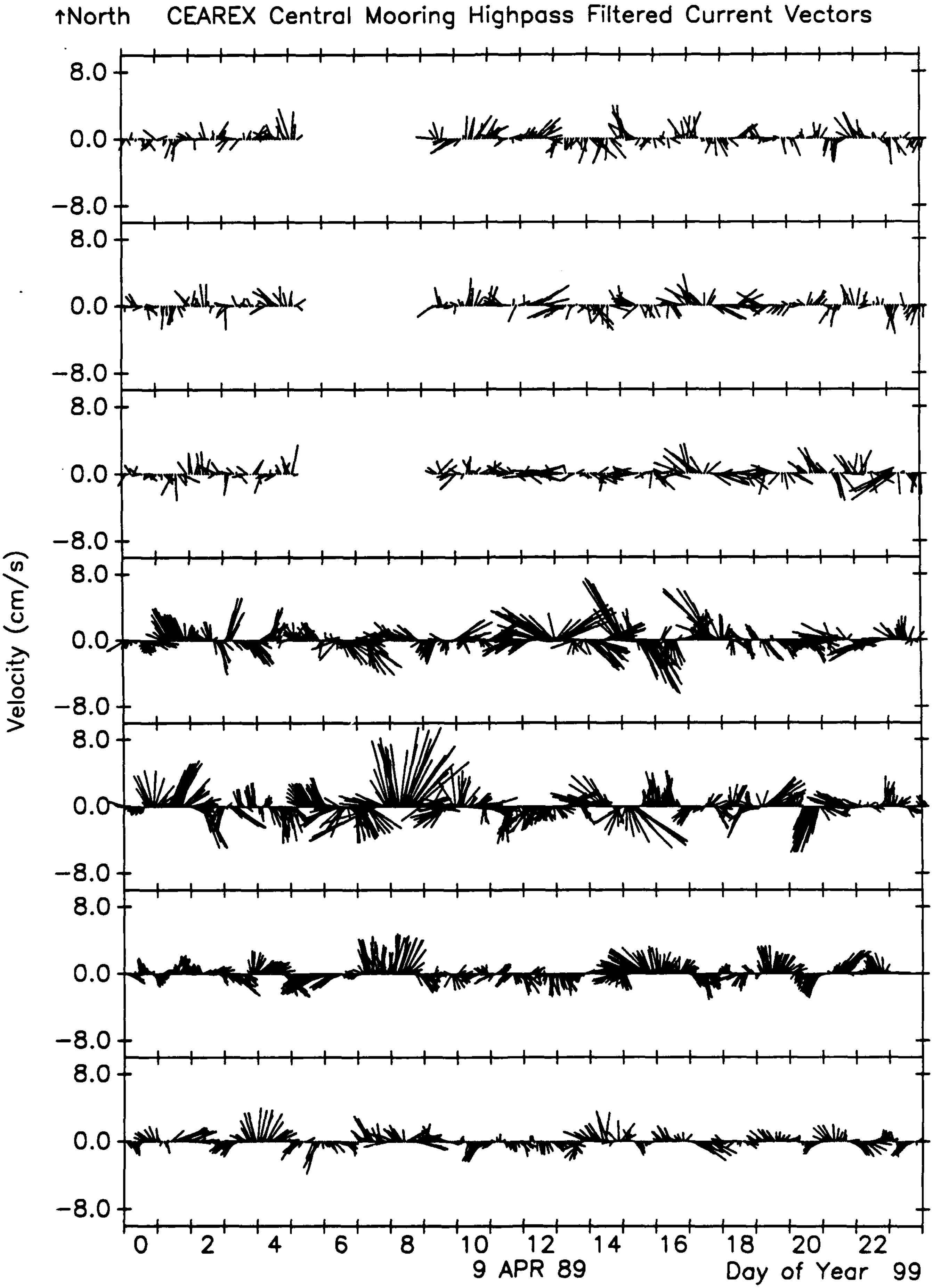
↑North CEAREX Central Mooring Highpass Filtered Current Vectors

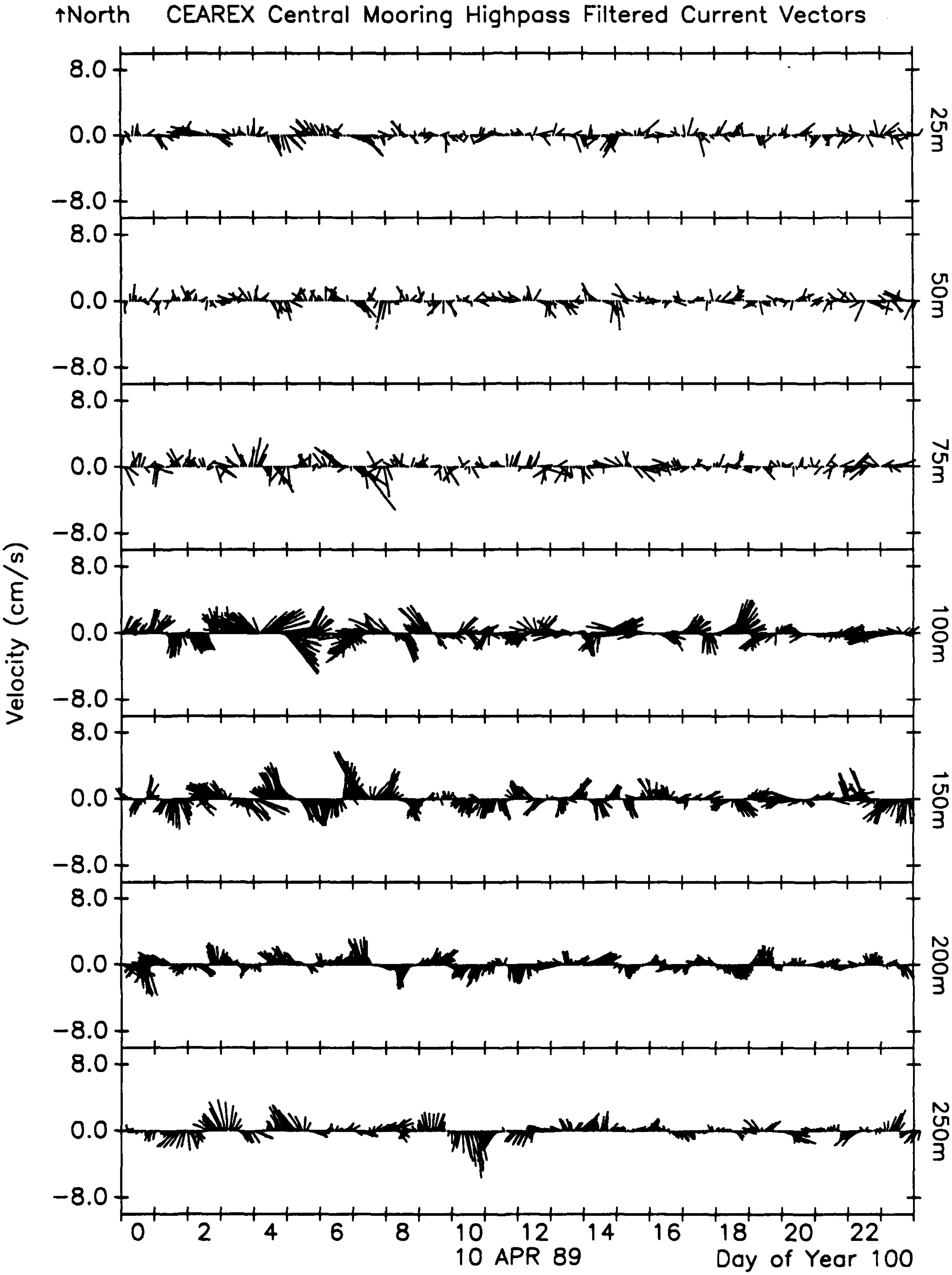


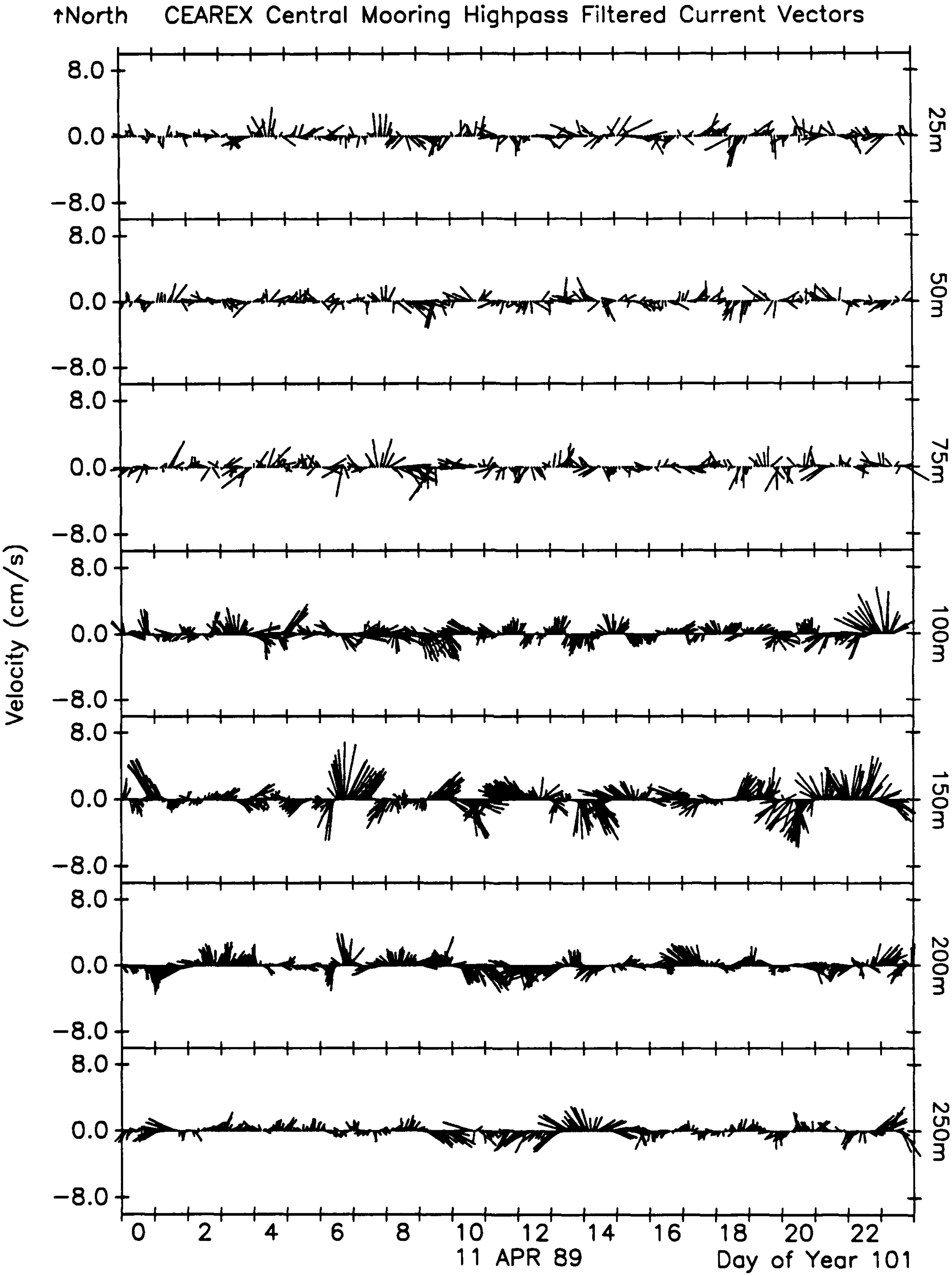

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
6 APR 89
Day of Year 96

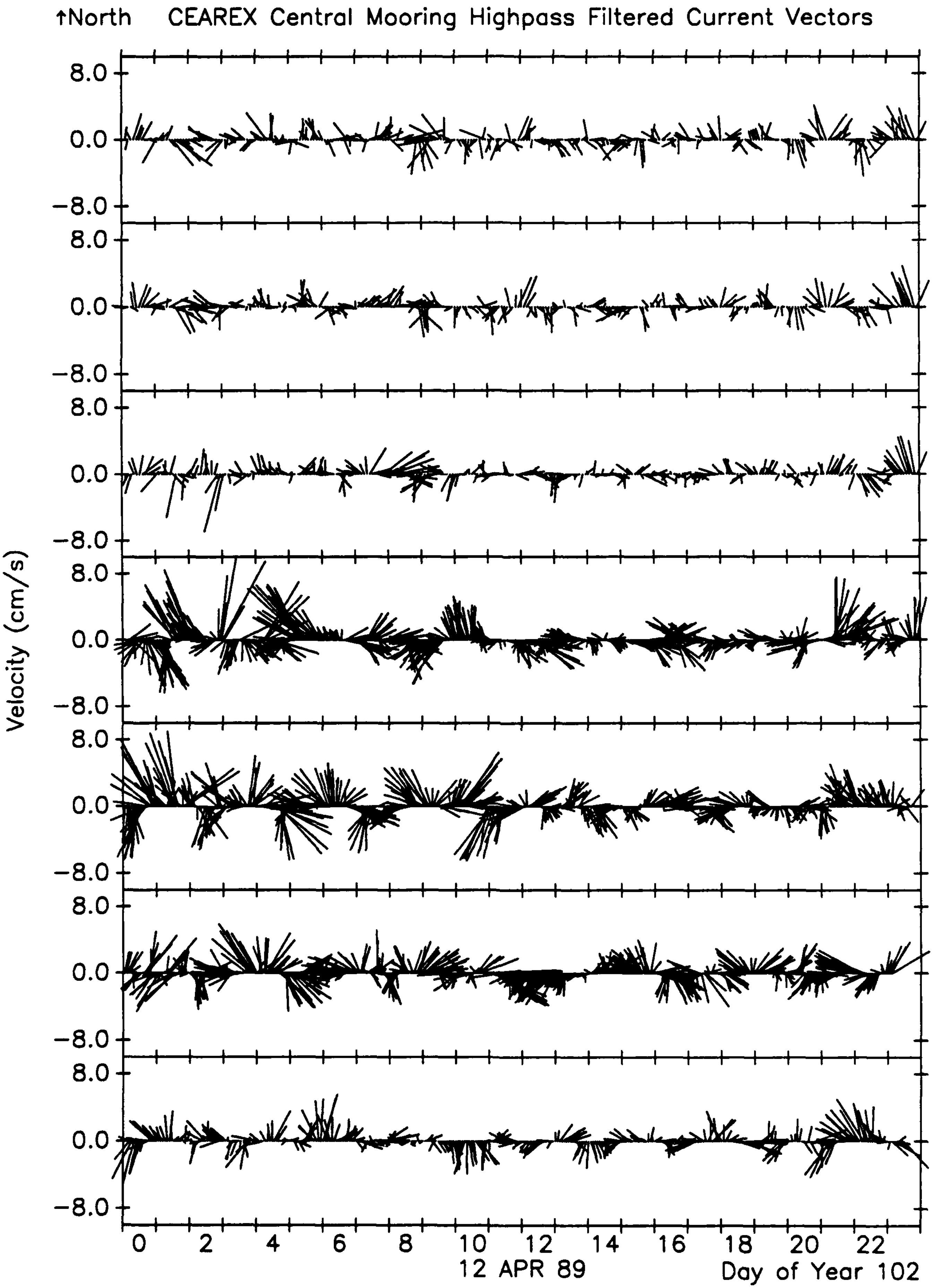

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
8.0
0.0
-8.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
7 APR 89
Day of Year 97

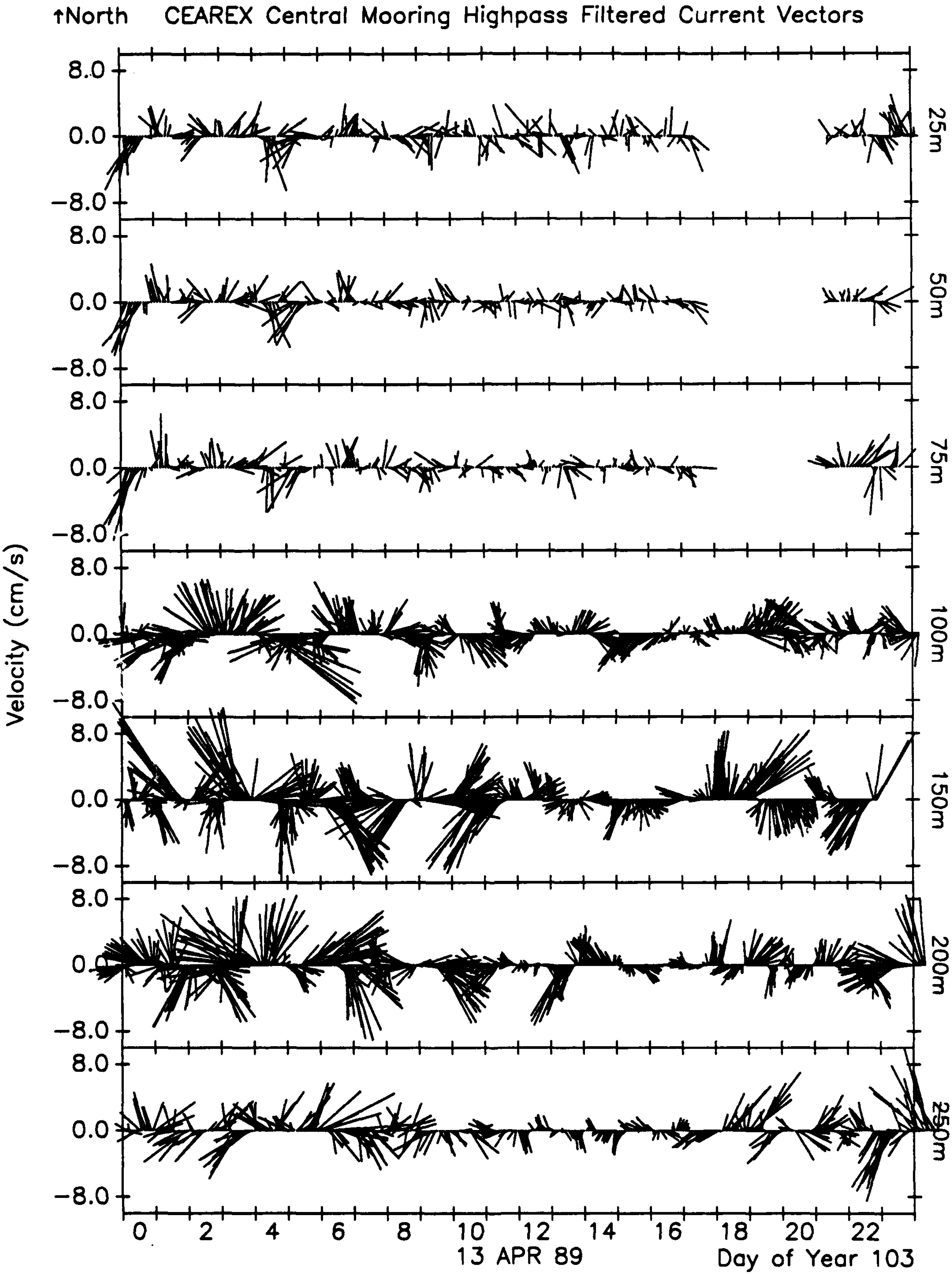

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
8 APR 89
Day of Year 98

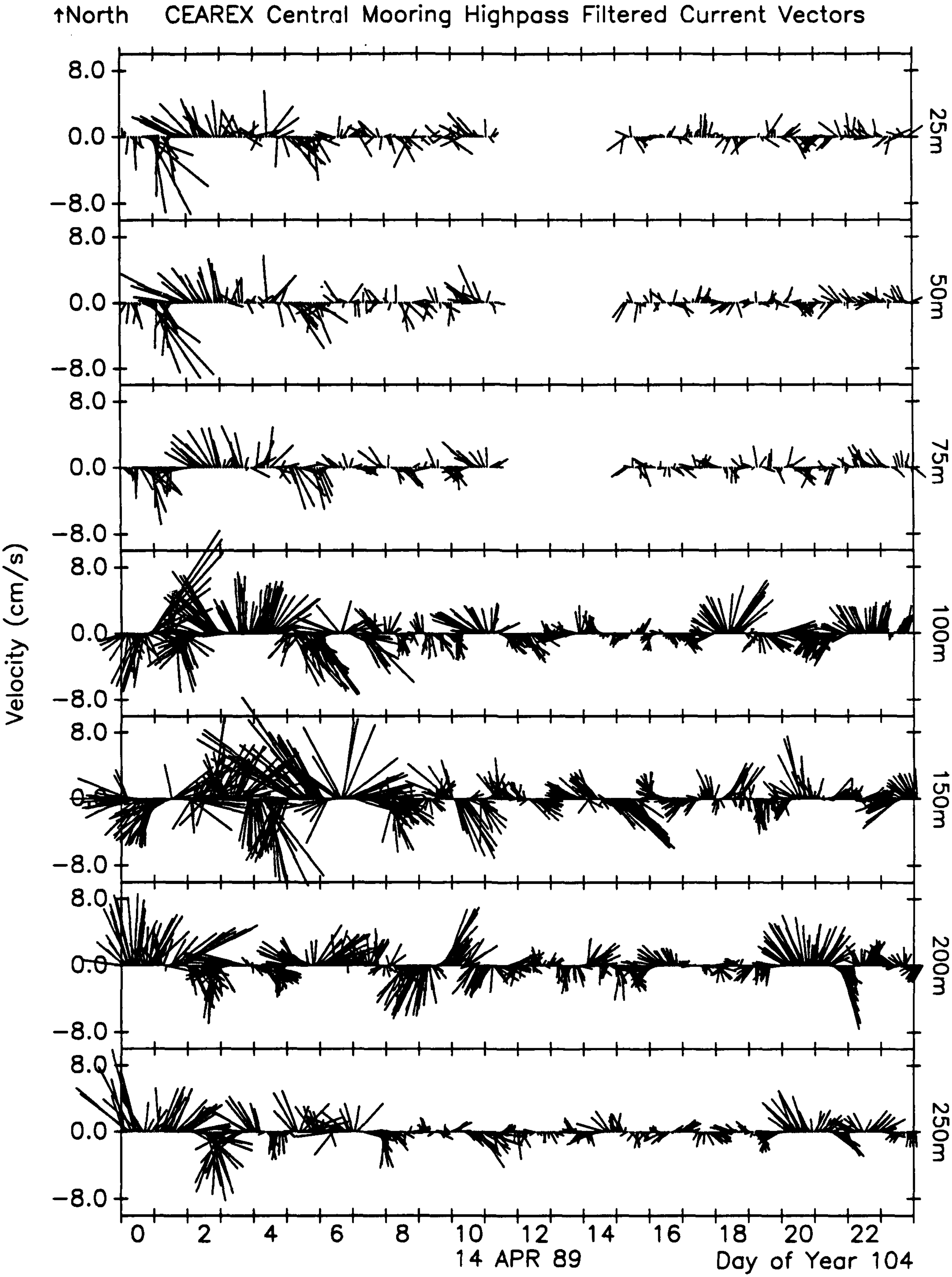

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
9 APR 89
Day of Year 99


↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
10 APR 89
Day of Year 100

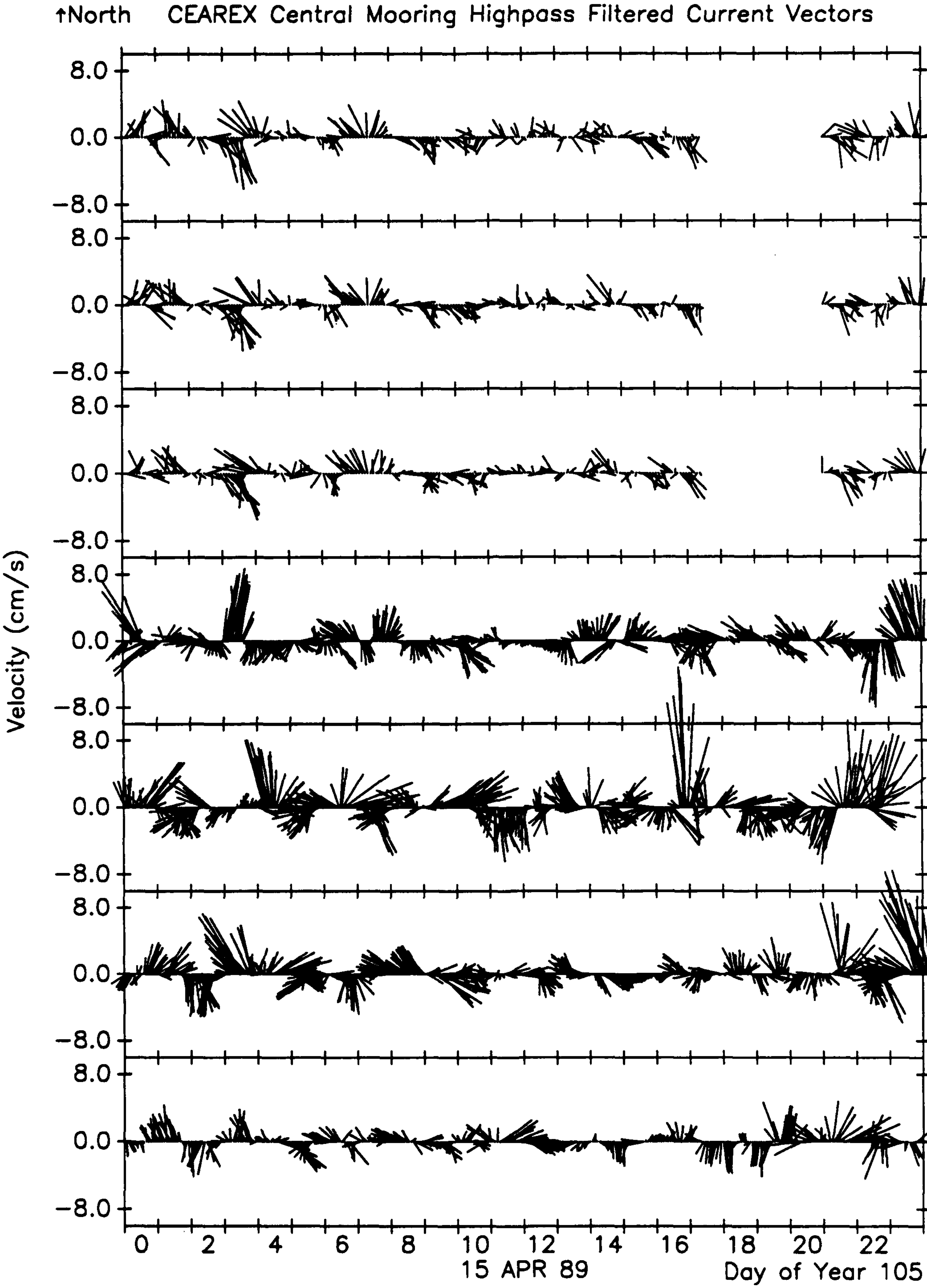

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
11 APR 89
Day of Year 101

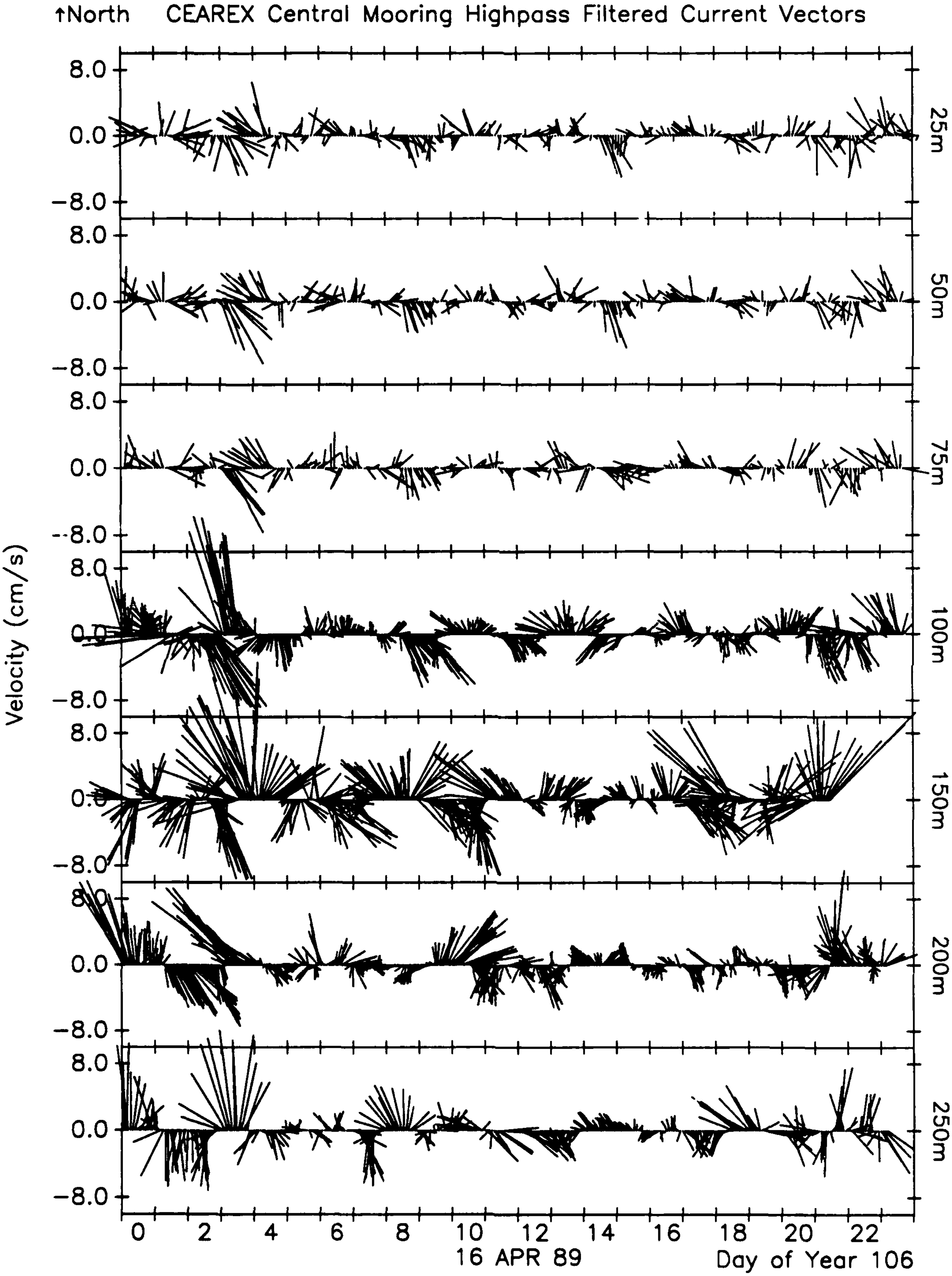

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
12 APR 89
Day of Year 102


↑North CEAREX Central Mooring Highpass Filtered Current Vectors
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
13 APR 89
Day of Year 103

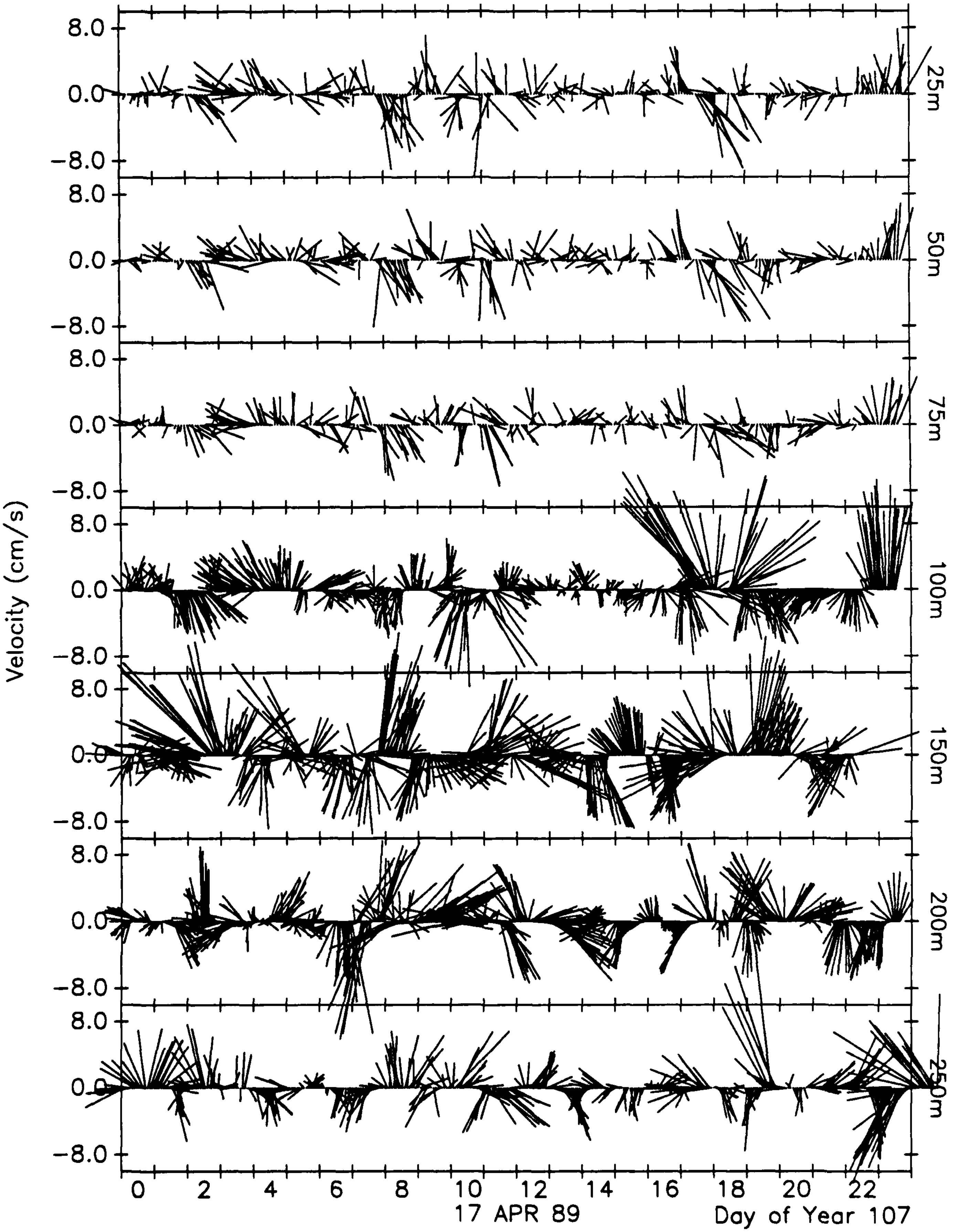


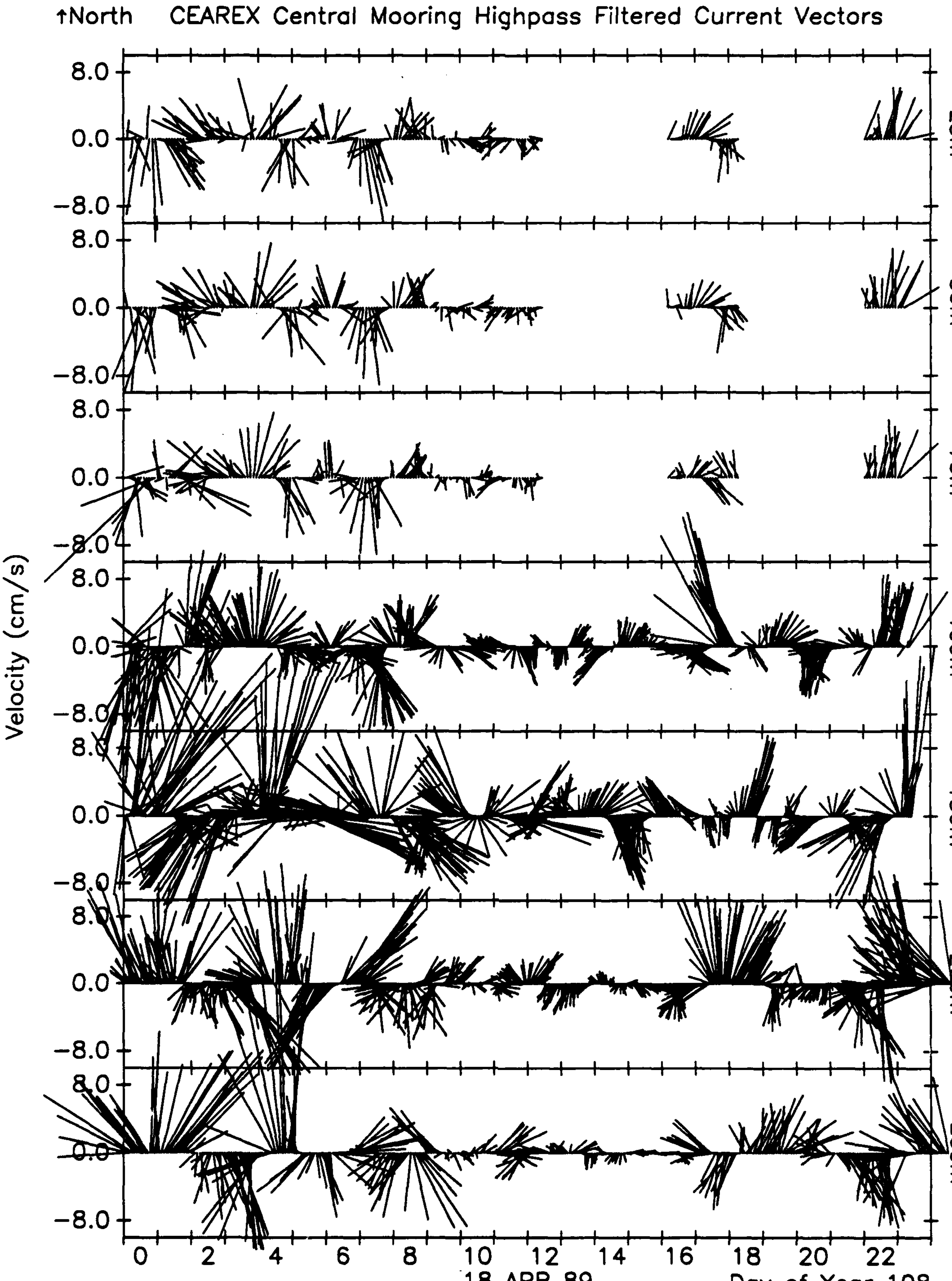
↑North CEAREX Central Mooring Highpass Filtered Current Vectors
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
14 APR 89
Day of Year 104

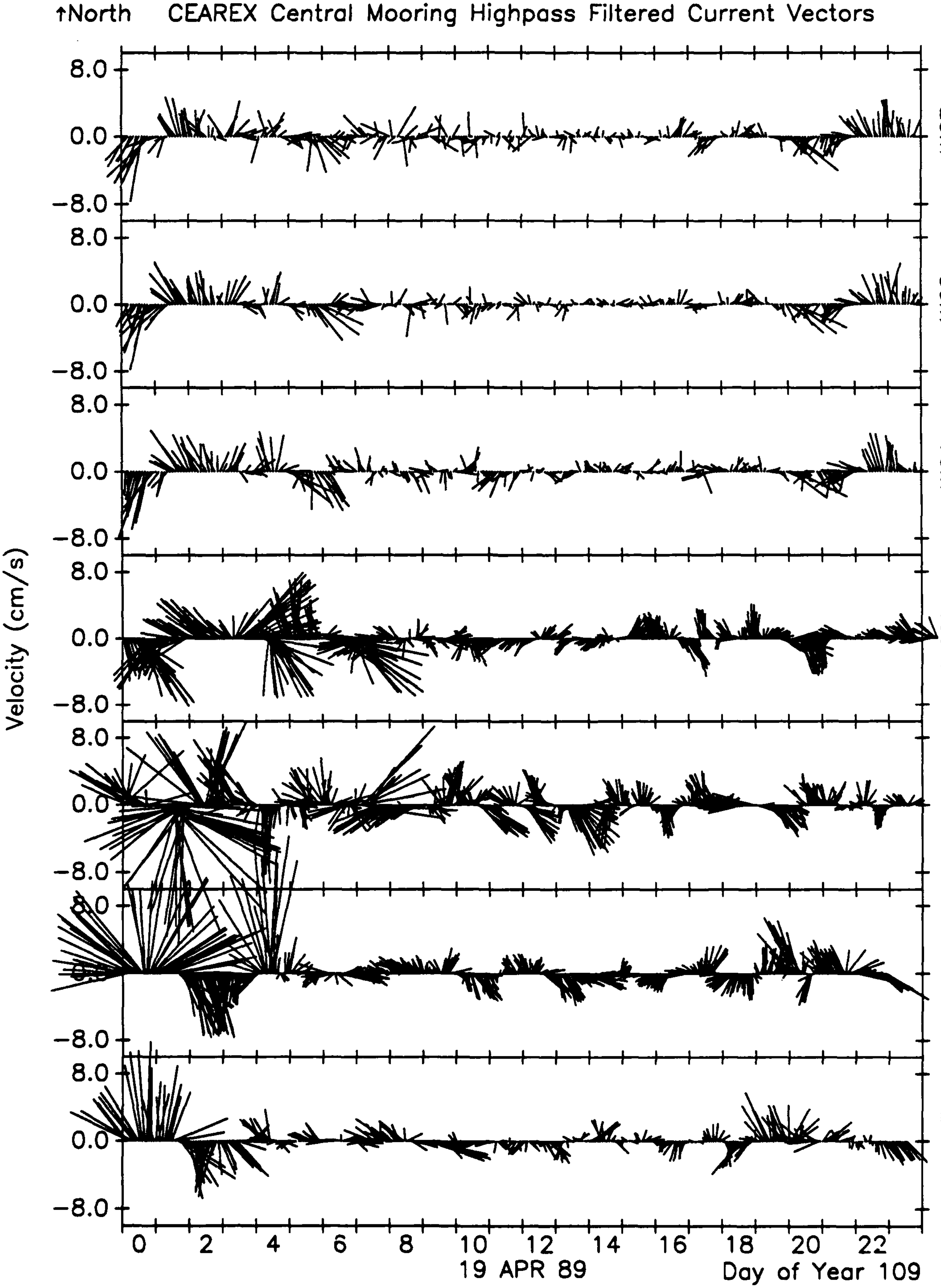

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
15 APR 89
Day of Year 105

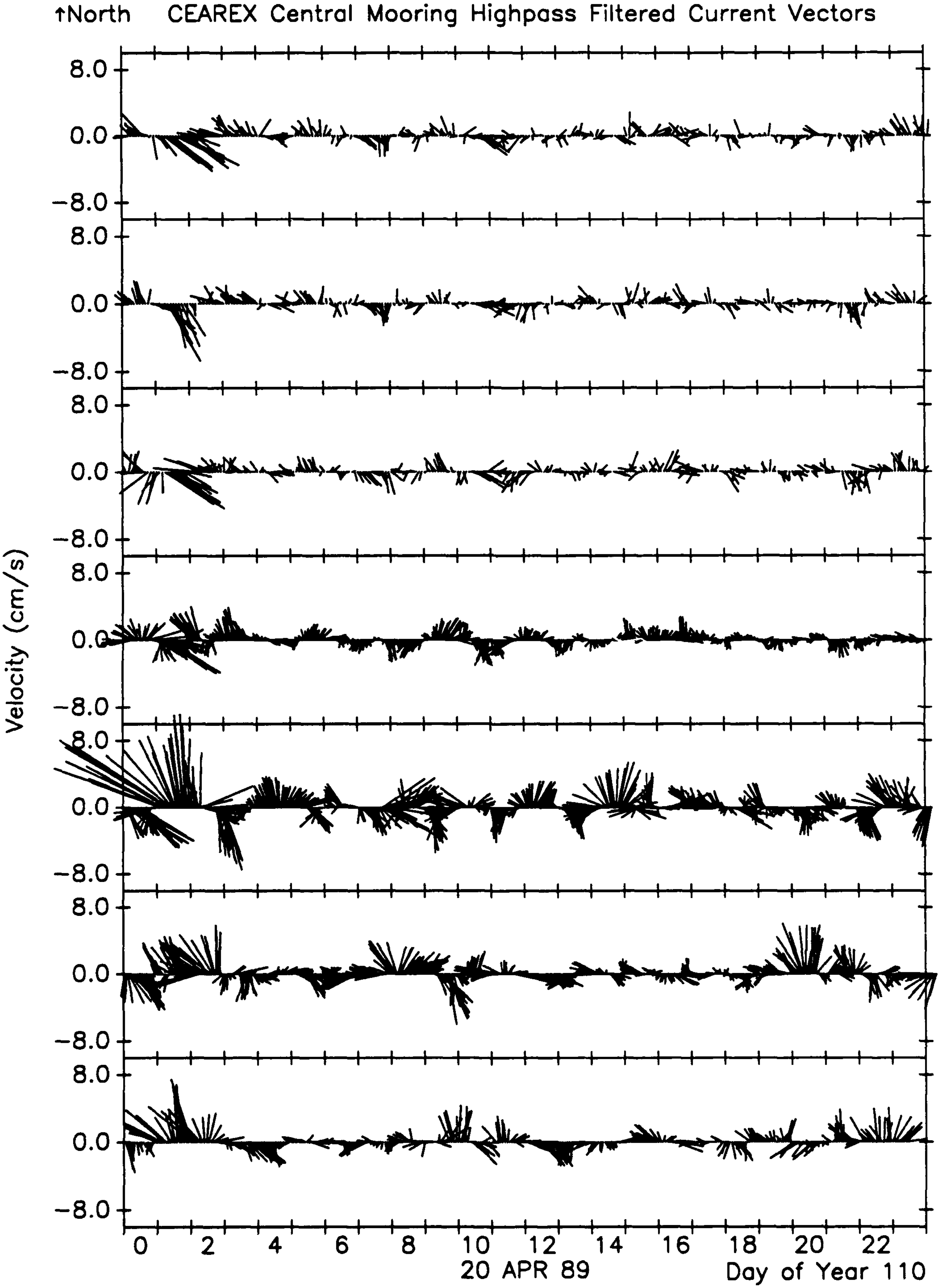

↑North
CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
16 APR 89
Day of Year 106

↑North CEAREX Central Mooring Highpass Filtered Current Vectors

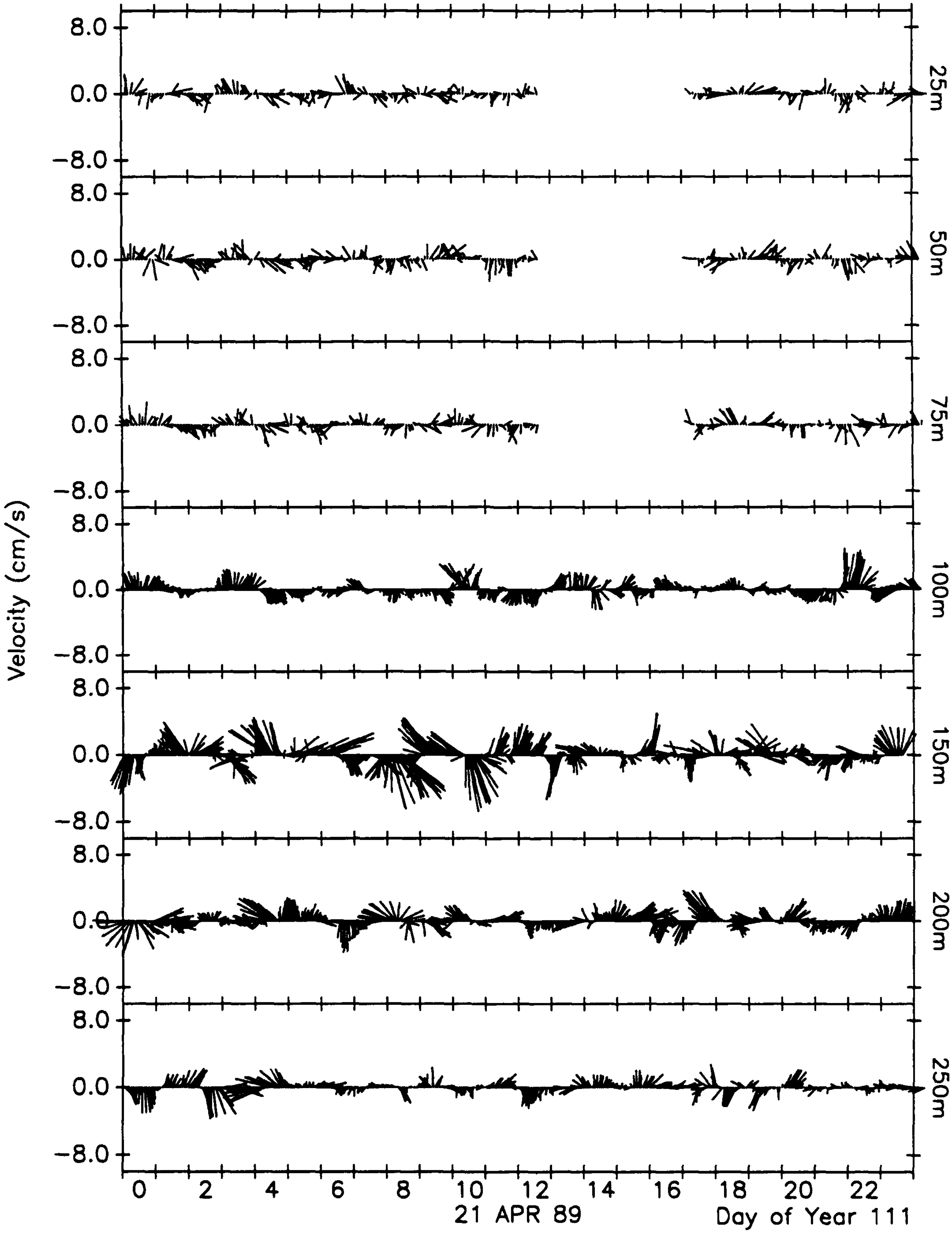


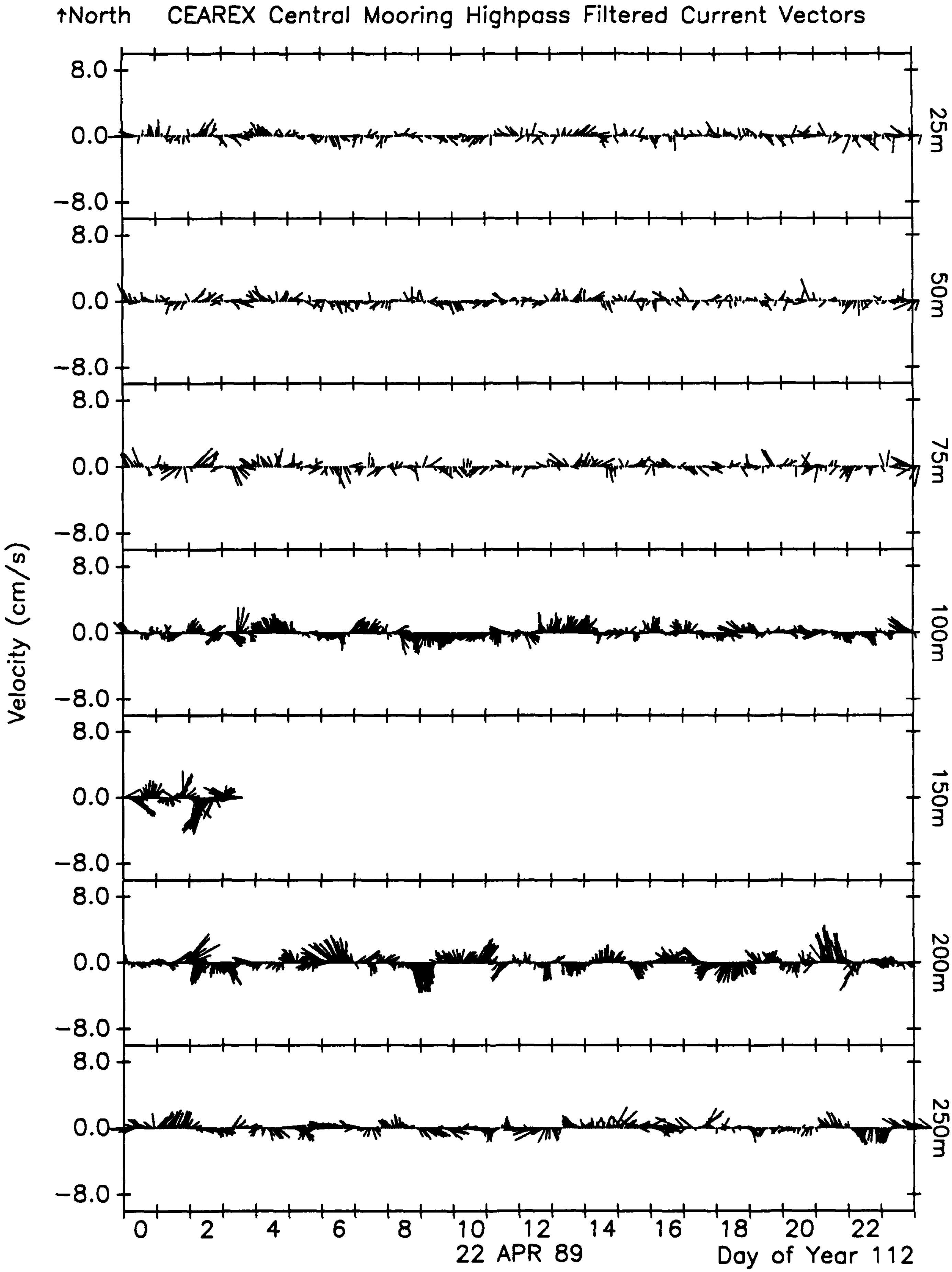

↑North
CEAREX Central Mooring Highpass Filtered Current Vectors
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
18 APR 89
Day of Year 108

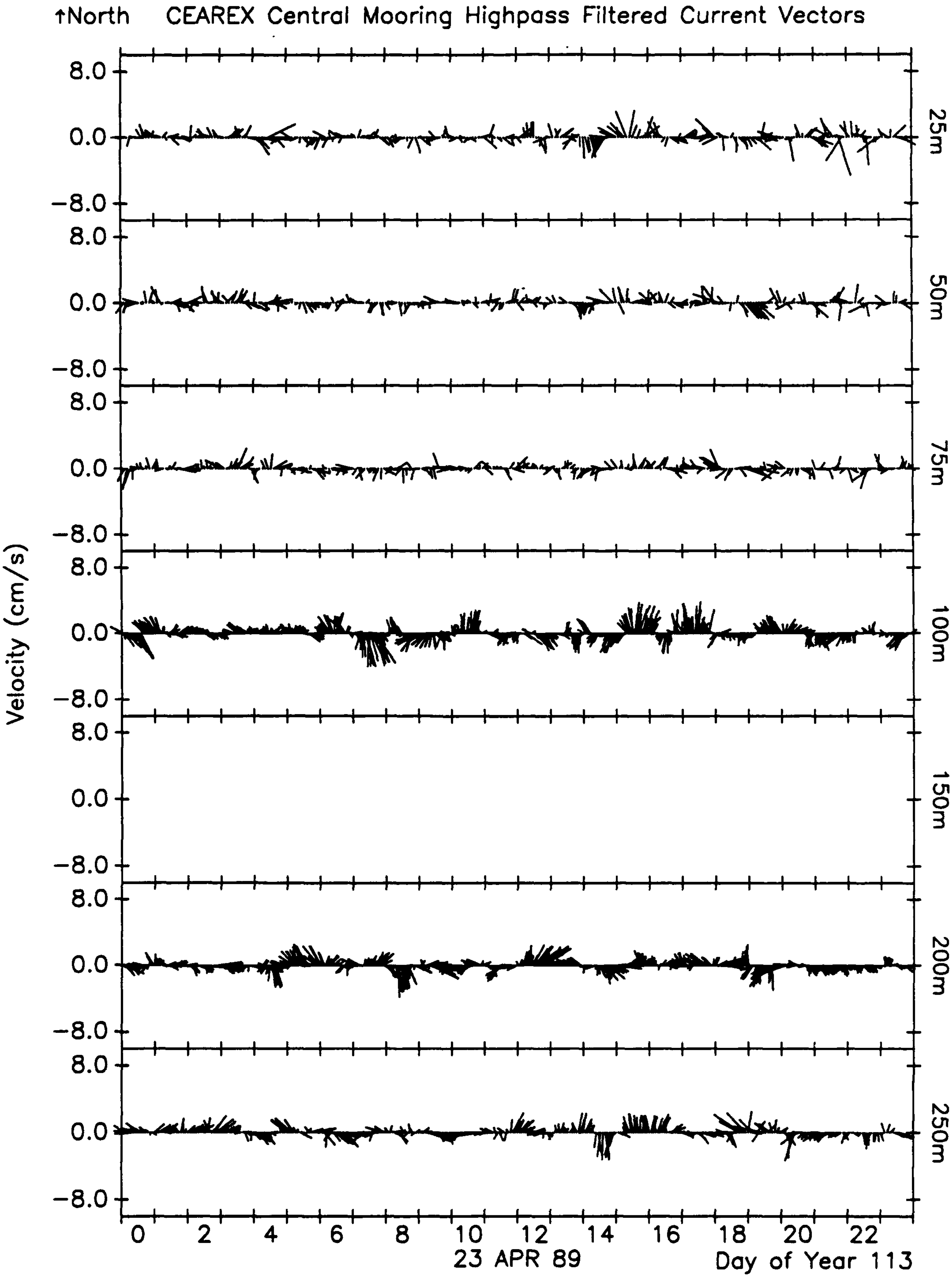

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
-8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
19 APR 89
Day of Year 109

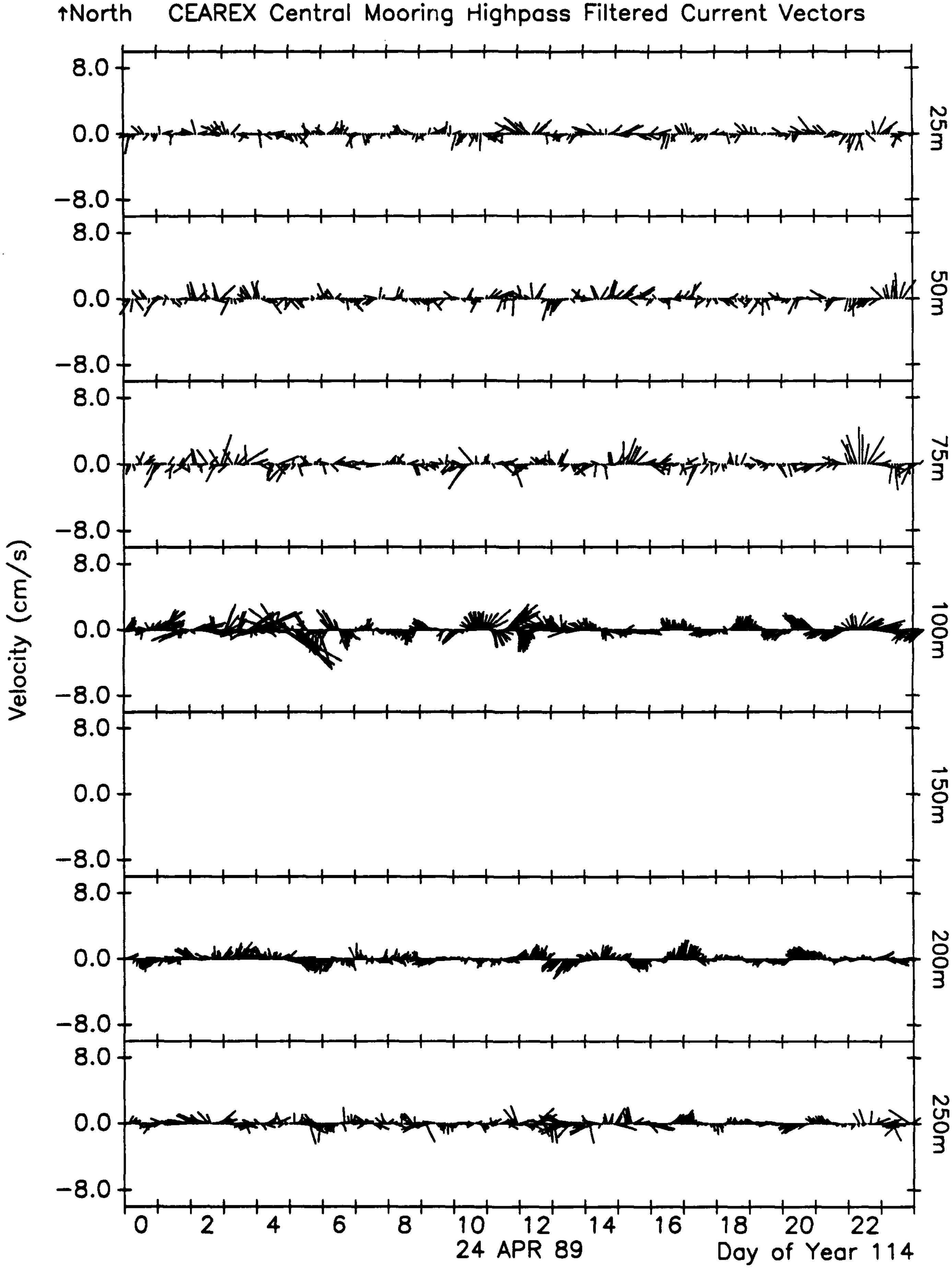

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
20 APR 89
Day of Year 110

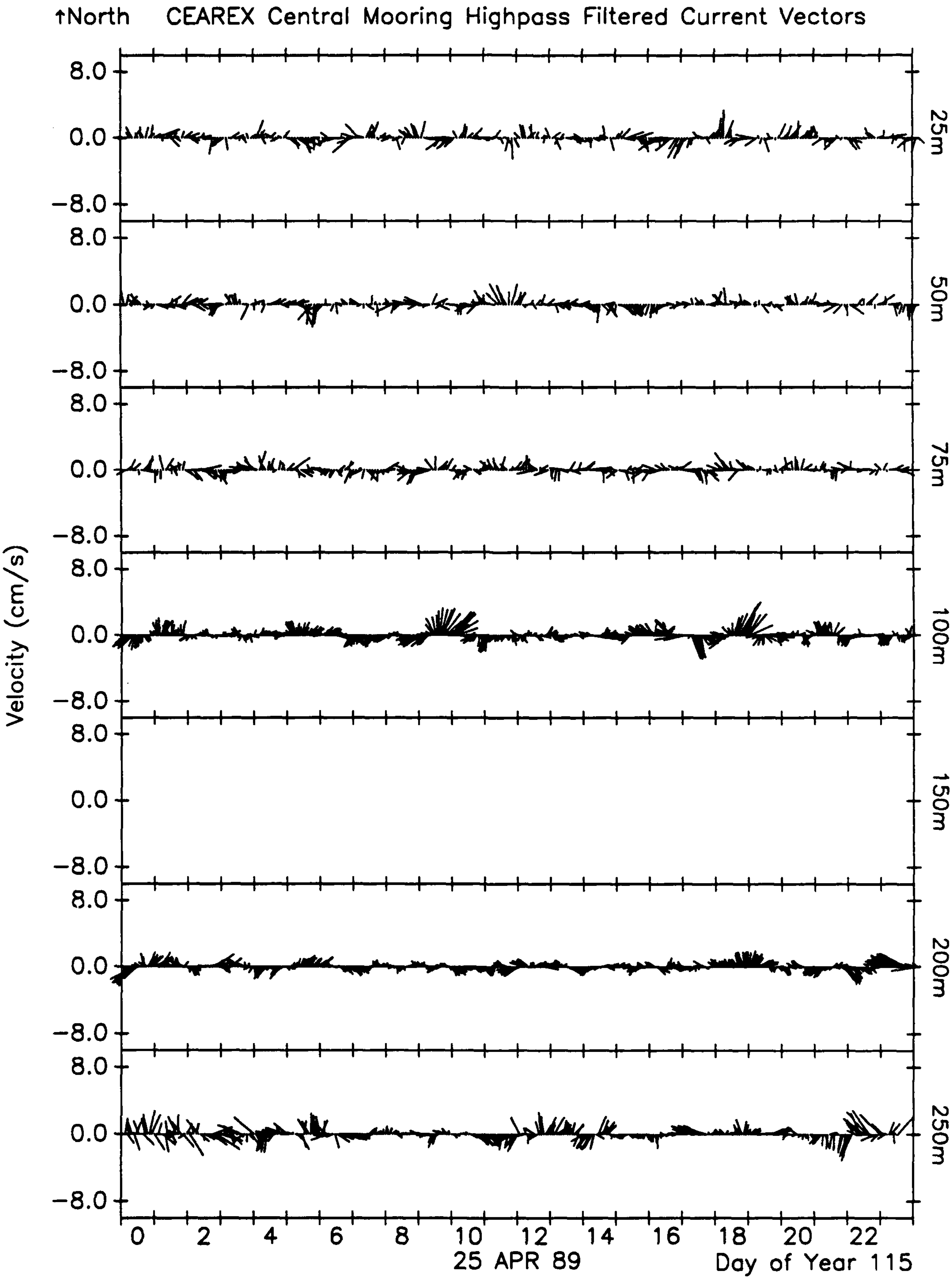
↑North CEAREX Central Mooring Highpass Filtered Current Vectors

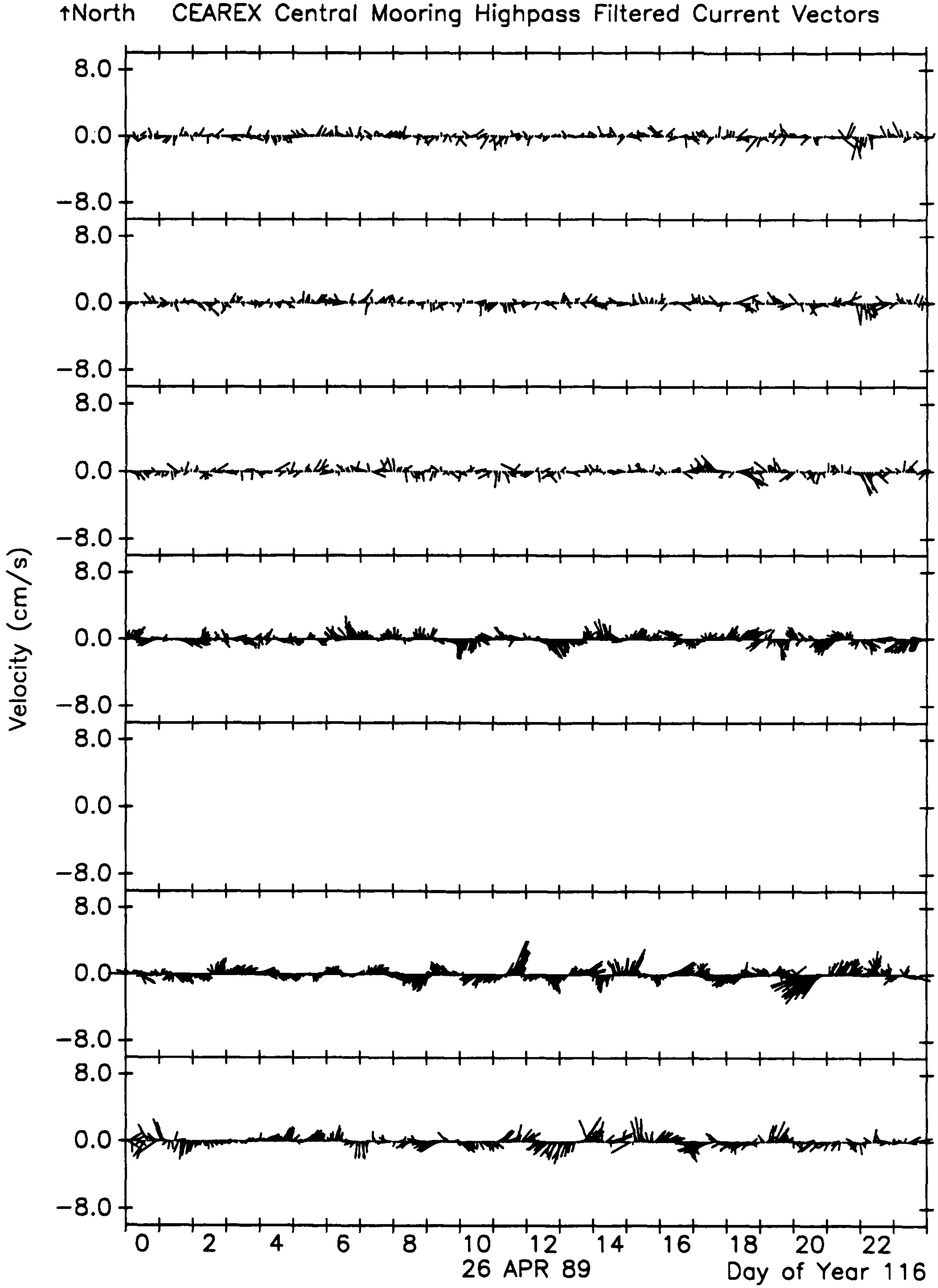


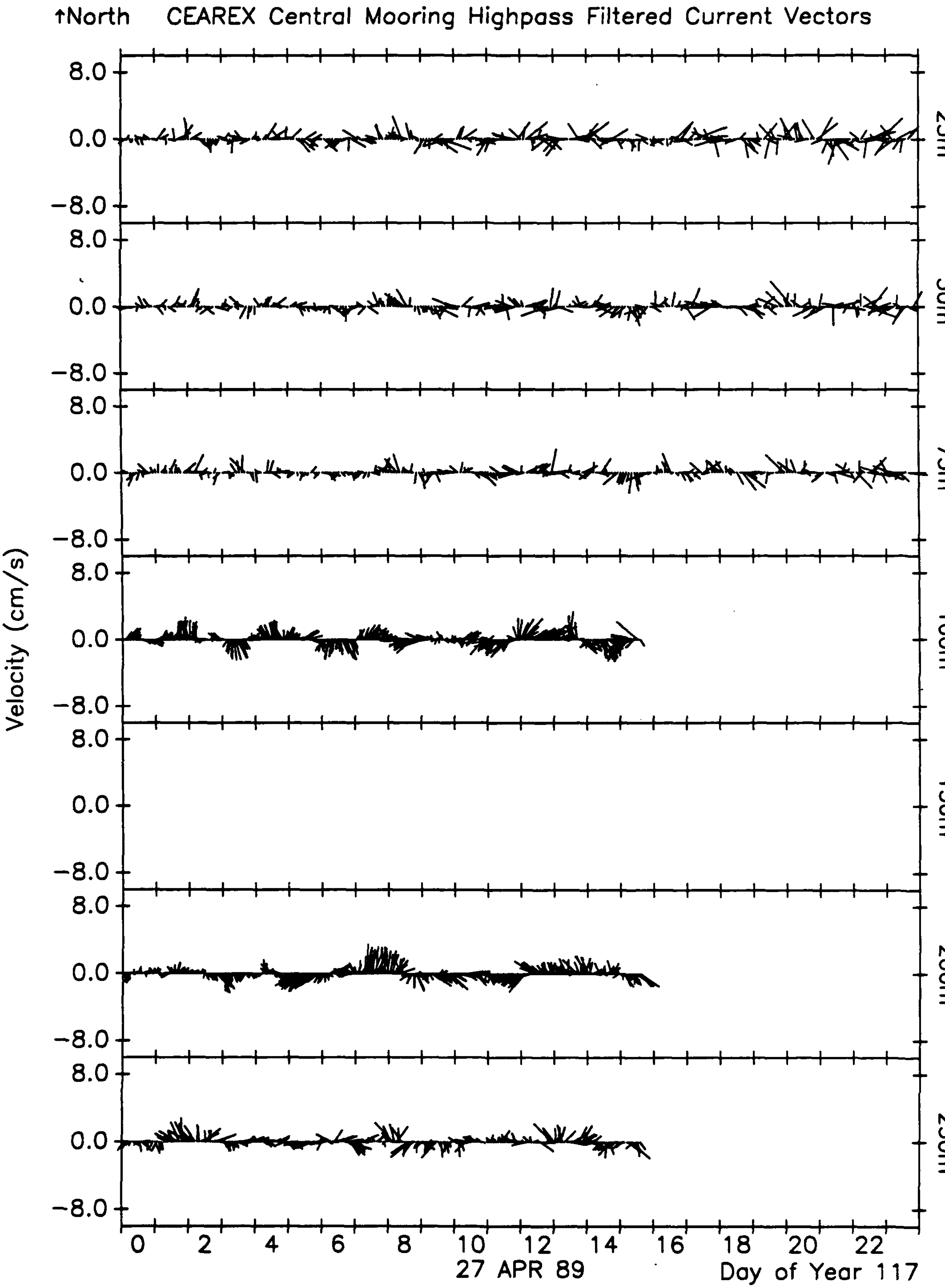

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0 2 4 6 8 10 12 14 16 18 20 22
22 APR 89
Day of Year 112


↑North CEAREX Central Mooring Highpass Filtered Current Vectors
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
23 APR 89
Day of Year 113

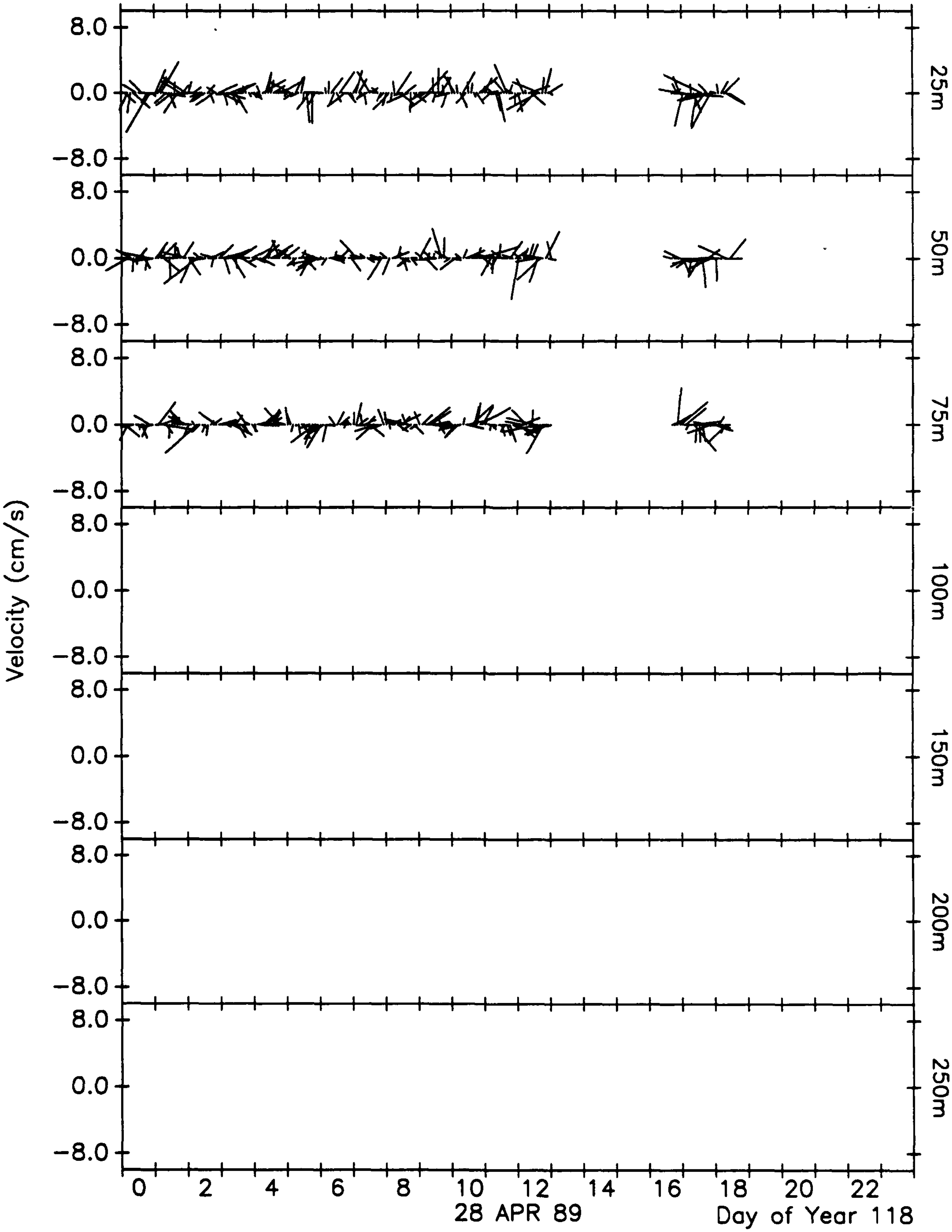

↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
24 APR 89
Day of Year 114


↑North CEAREX Central Mooring Highpass Filtered Current Vectors
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
25 APR 89
Day of Year 115


↑North CEAREX Central Mooring Highpass Filtered Current Vectors
8.0
0.0
-8.0
25m
50m
75m
100m
150m
200m
250m
Velocity (cm/s)
0
2
4
6
8
10
12
14
16
18
20
22
26 APR 89
Day of Year 116


↑North CEAREX Central Mooring Highpass Filtered Current Vectors
Velocity (cm/s)
8.0
0.0
−8.0
25m
50m
75m
100m
150m
200m
250m
0
2
4
6
8
10
12
14
16
18
20
22
27 APR 89
Day of Year 117

↑North CEAREX Central Mooring Highpass Filtered Current Vectors

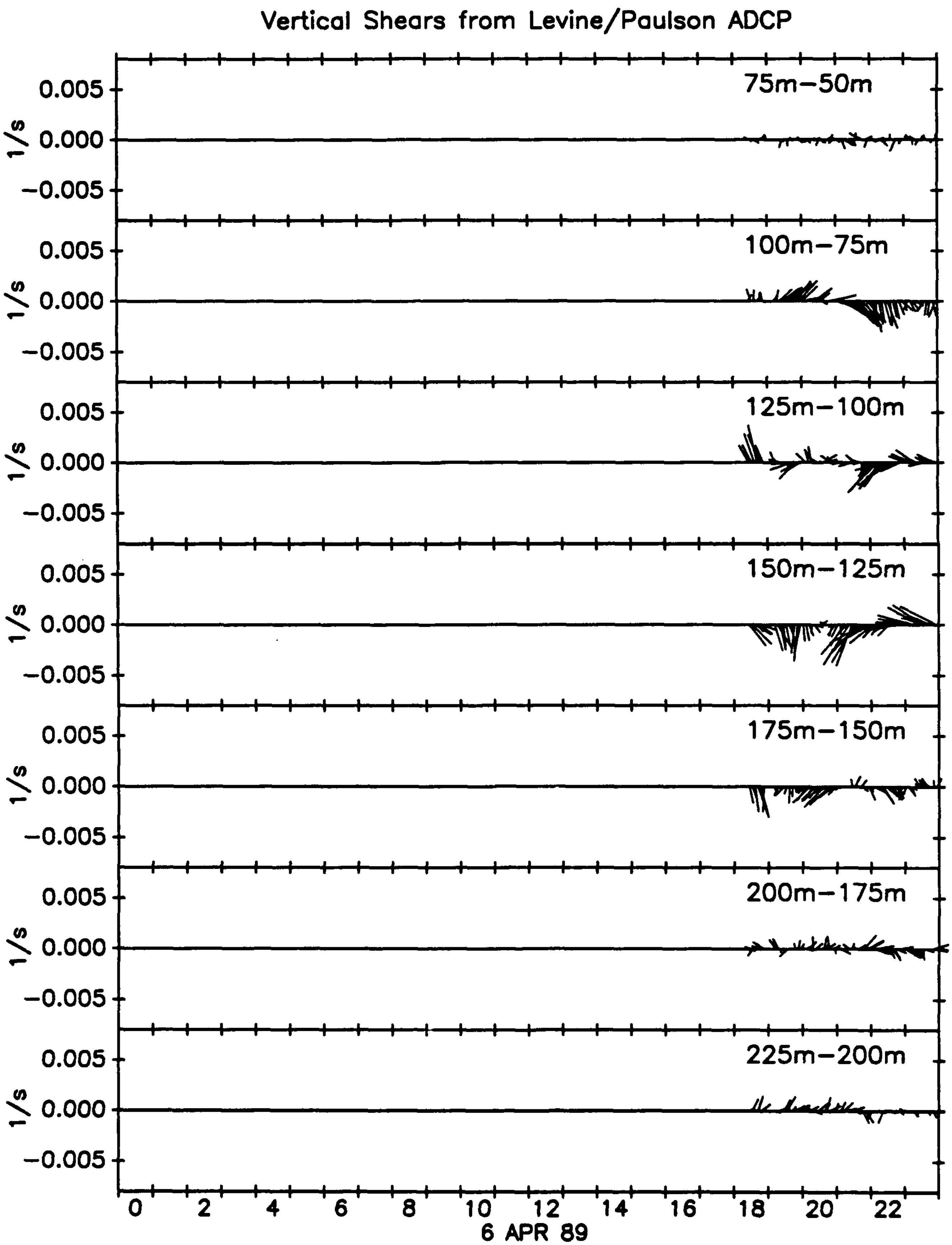


TIME SERIES OF VERTICAL SHEAR AT CENTRAL SITE: UNFILTERED

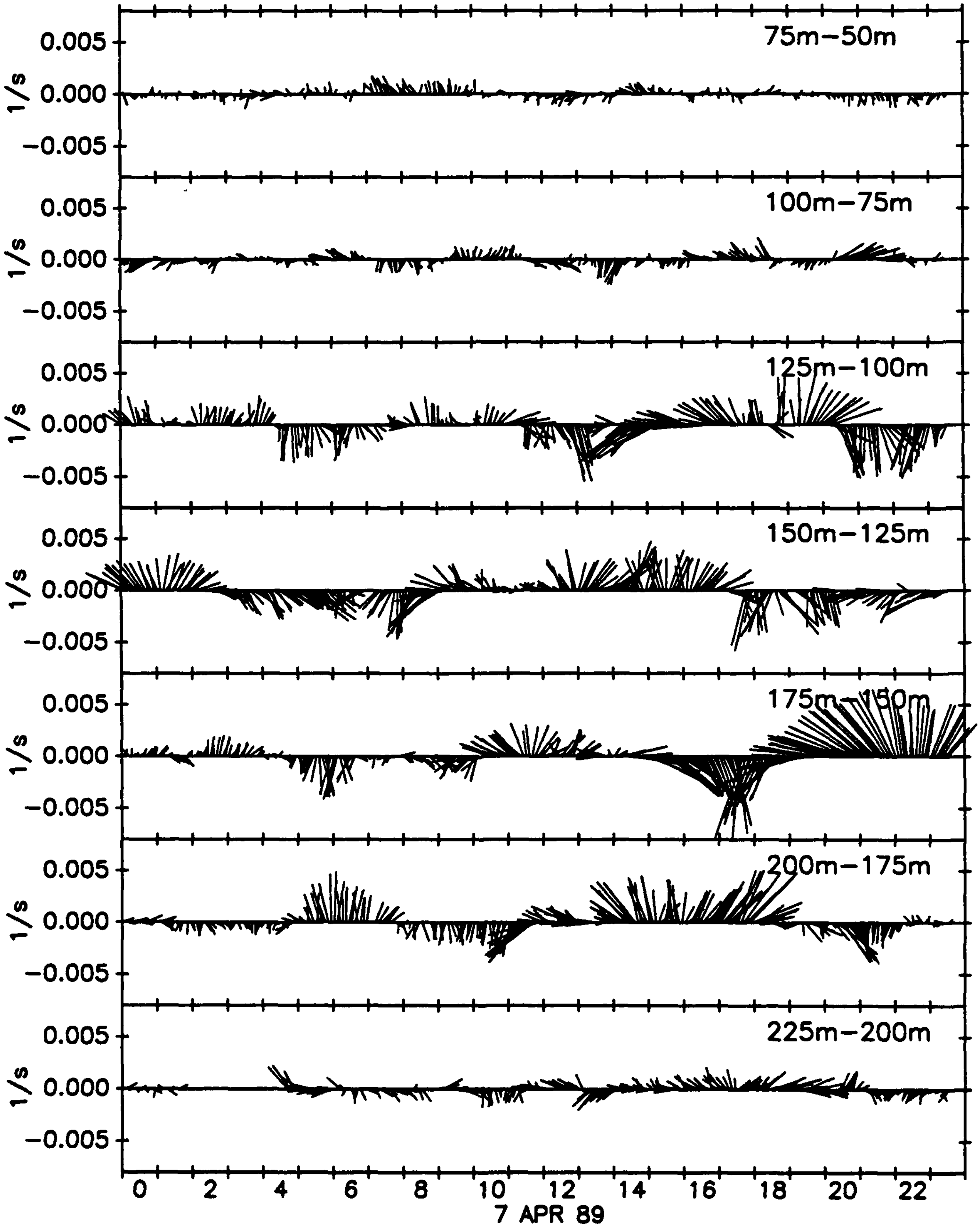
On the following 23 pages are observations of vertical shear of horizontal velocity defined by

$$\frac{\vec{u}_{shallower} - \vec{u}_{deeper}}{25m}$$

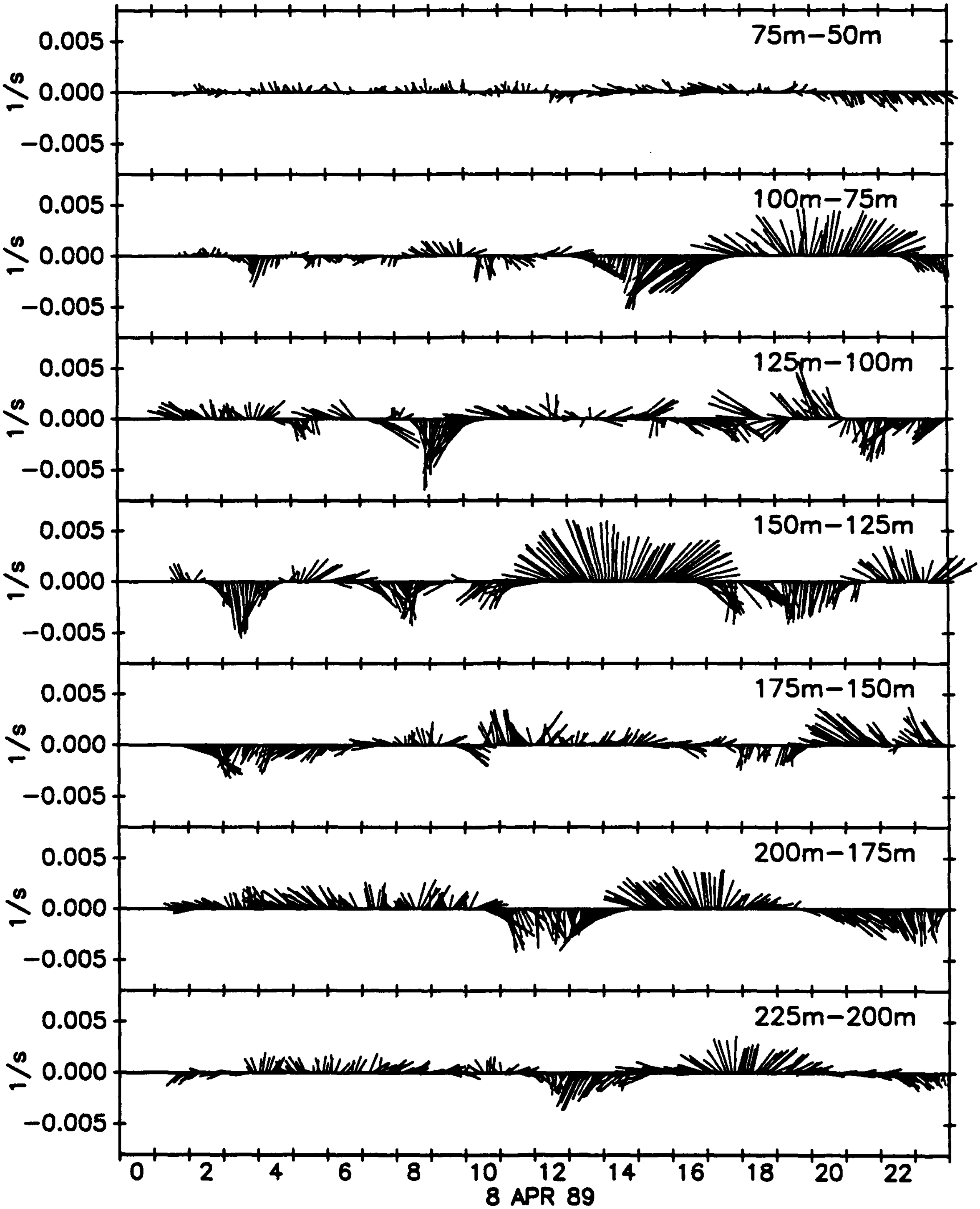
Observations are from the ADCP--5 minute averaged values. (See Table 2.)


Vertical Shears from Levine/Paulson ADCP
75m–50m
100m–75m
125m–100m
150m–125m
175m–150m
200m–175m
225m–200m
1/s
0.005
0.000
–0.005
0
2
4
6
8
10
12
14
16
18
20
22
6 APR 89

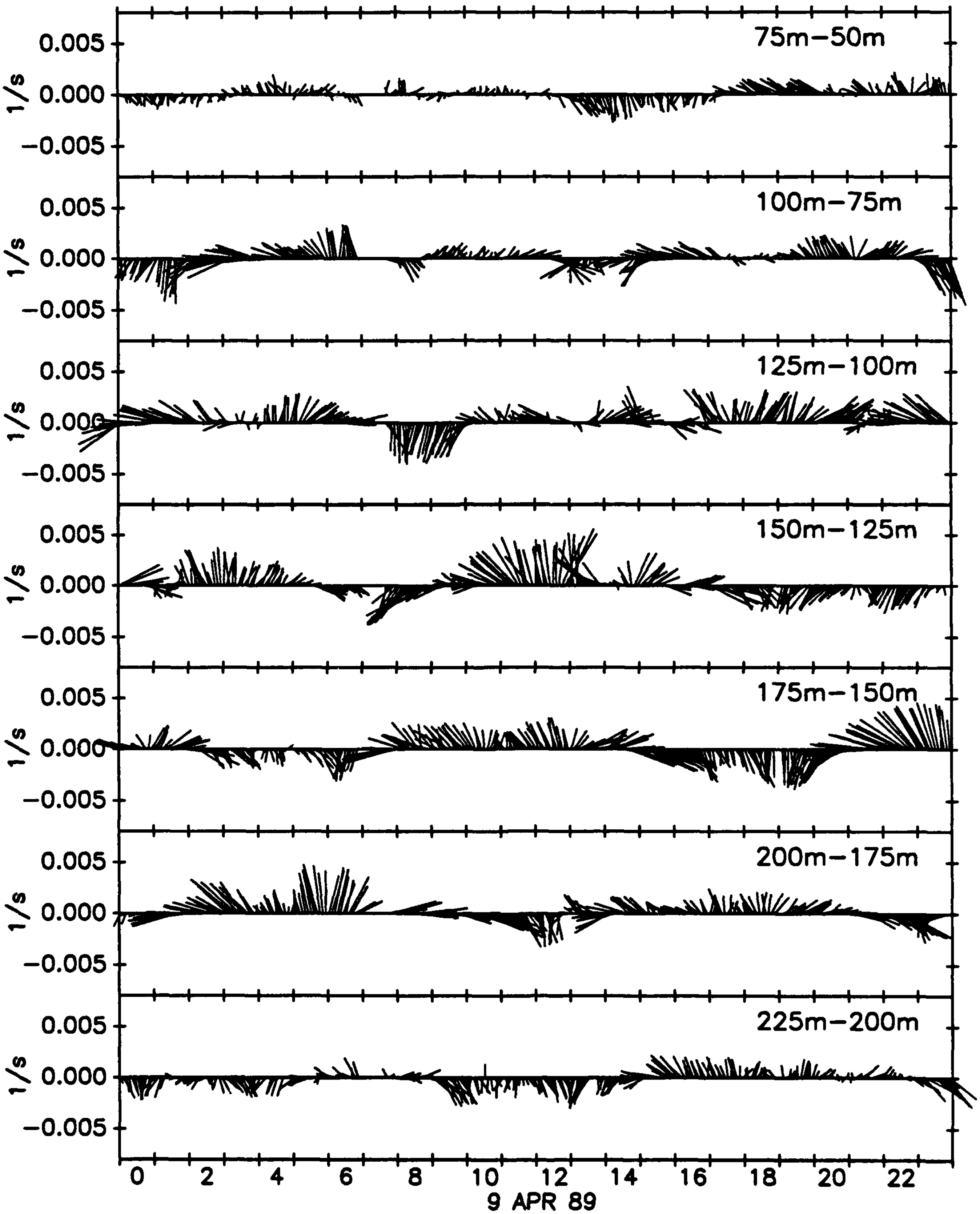
Vertical Shears from Levine/Paulson ADCP



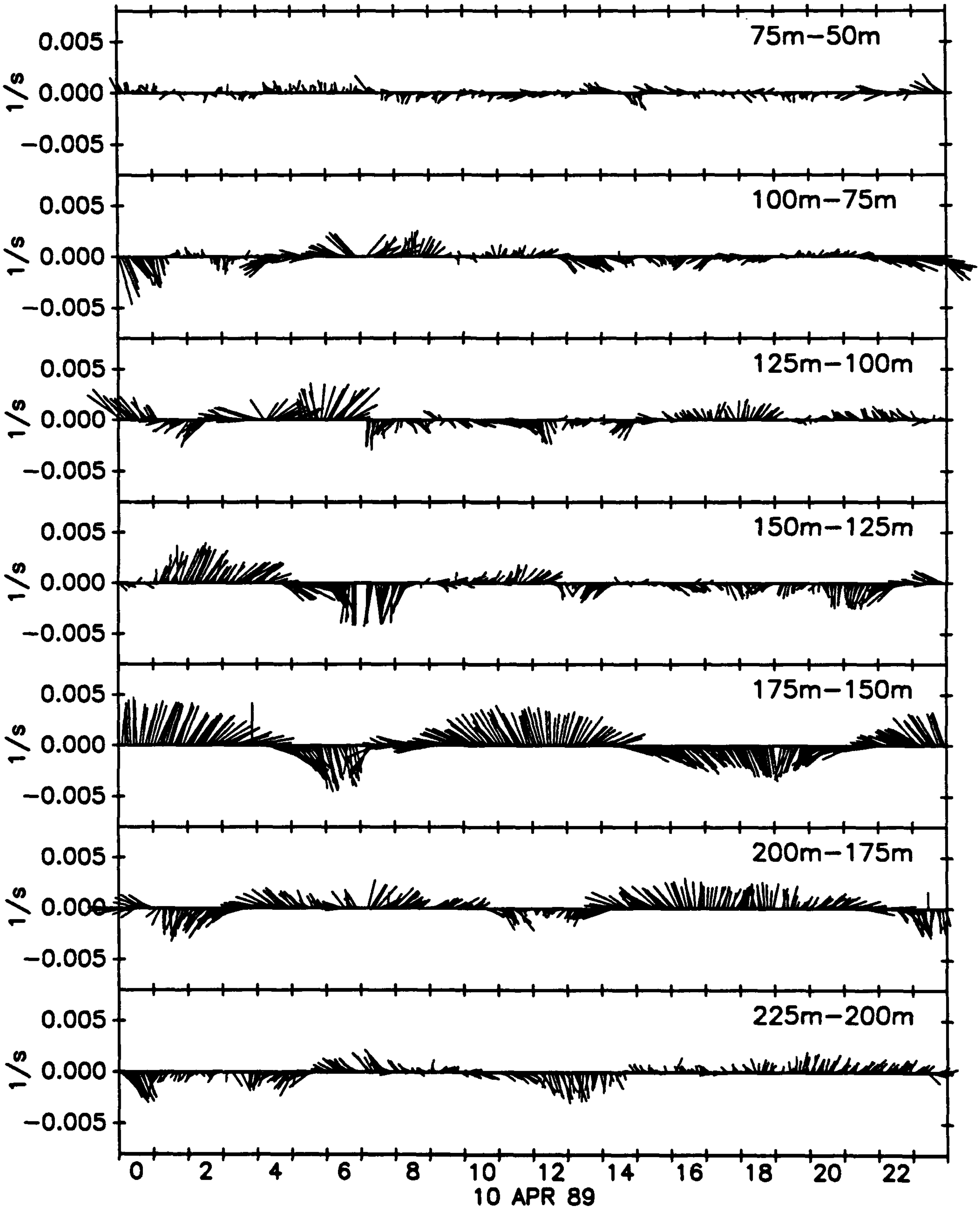
Vertical Shears from Levine/Paulson ADCP

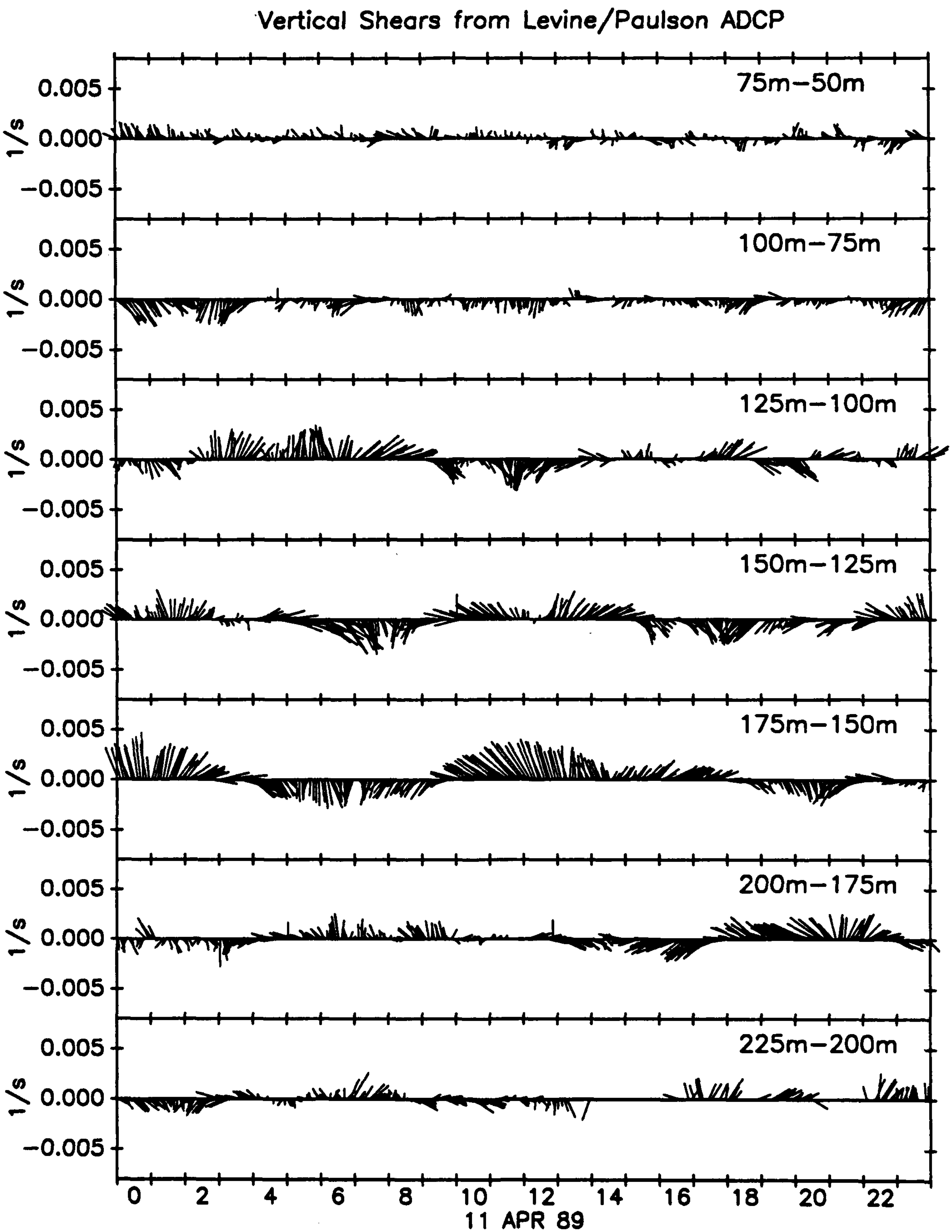


Vertical Shears from Levine/Paulson ADCP



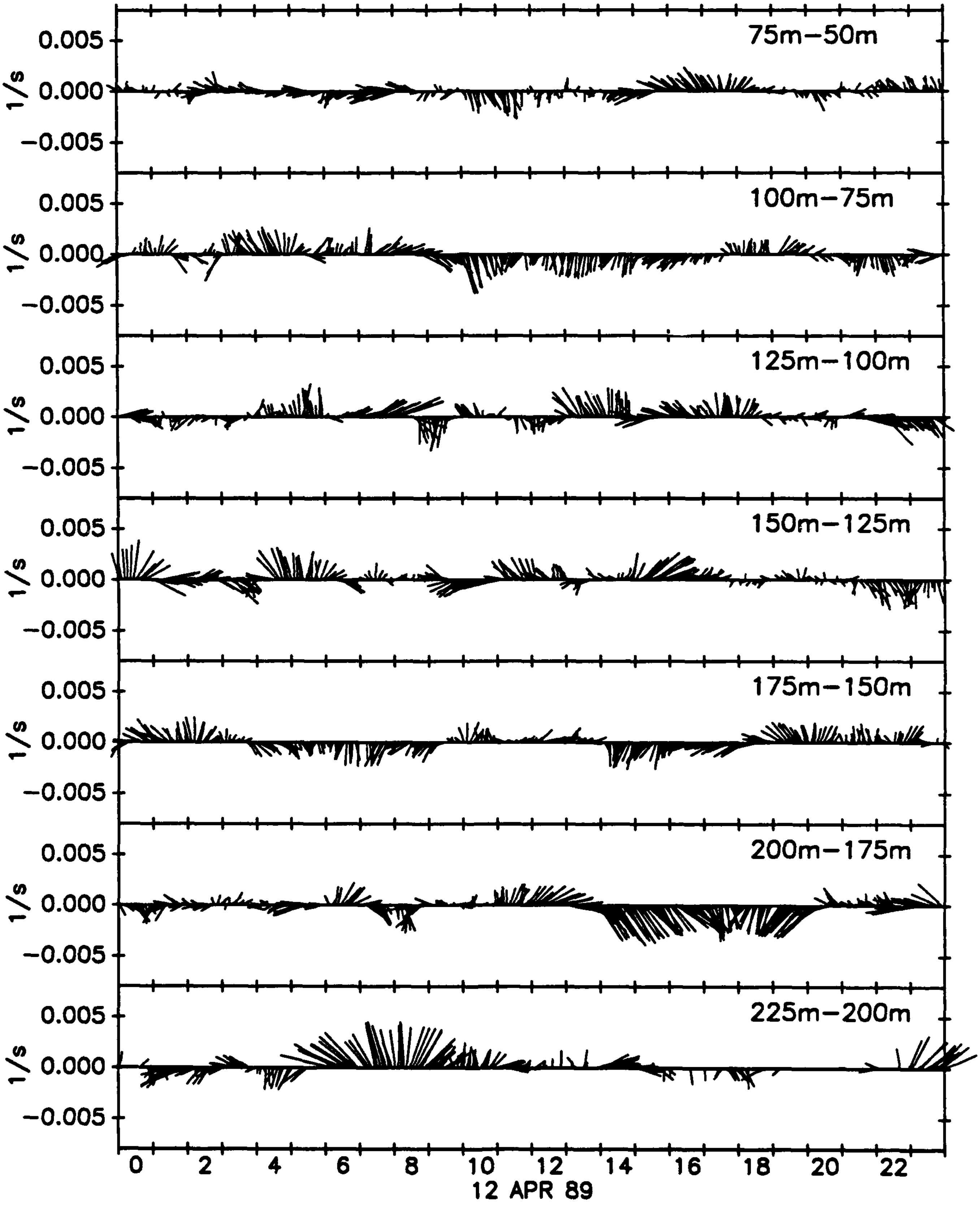
Vertical Shears from Levine/Paulson ADCP

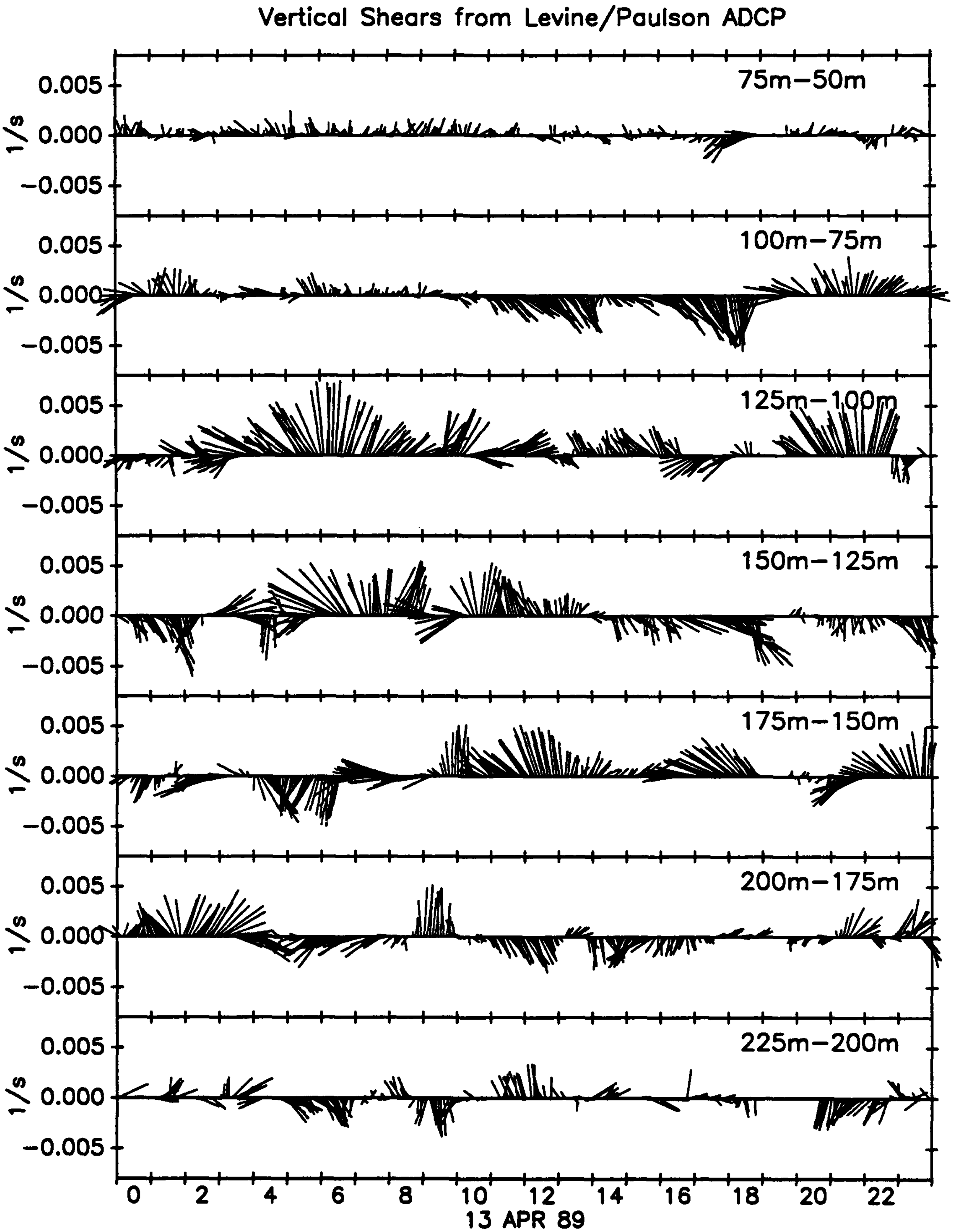


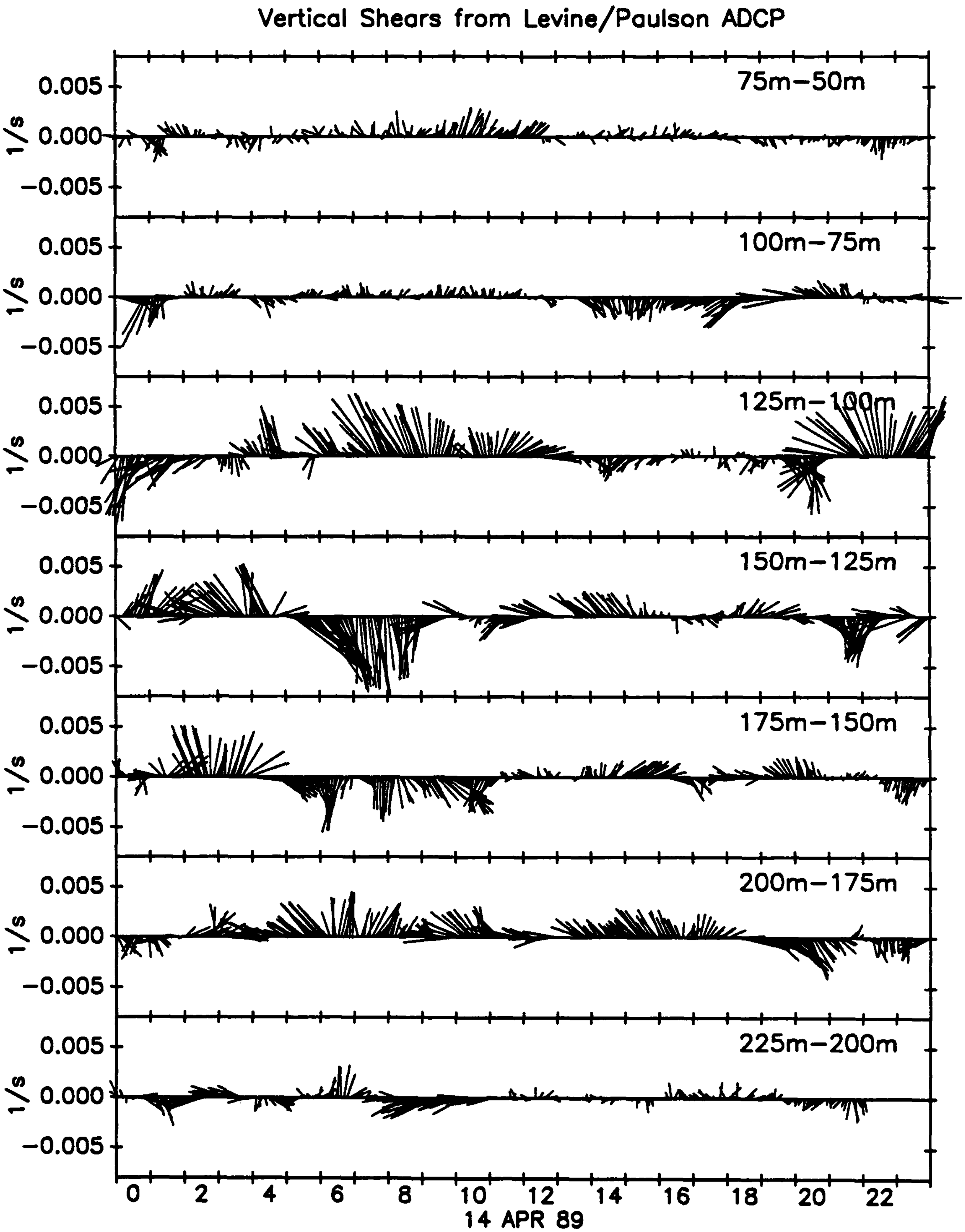


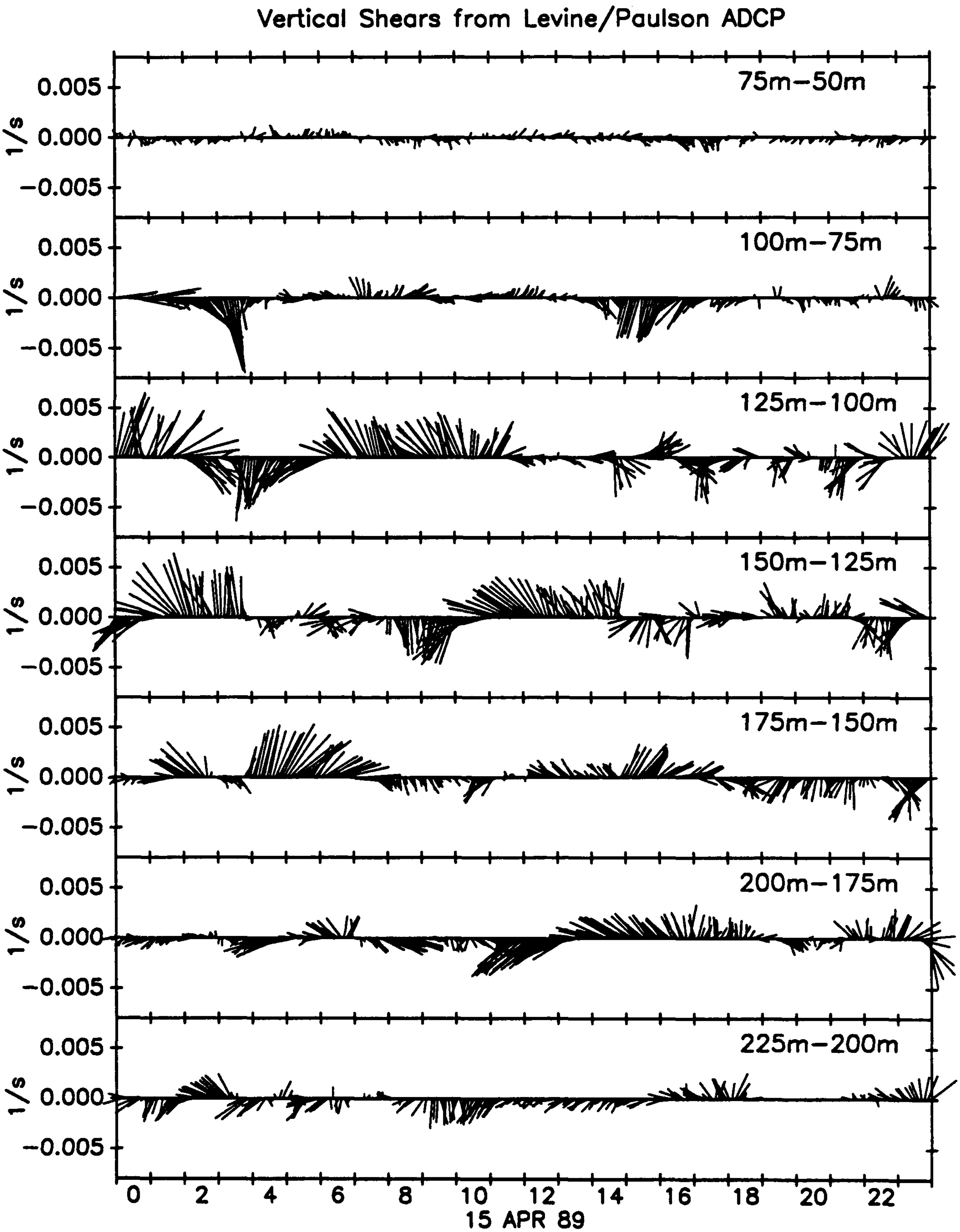
Vertical Shears from Levine/Paulson ADCP
75m−50m
100m−75m
125m−100m
150m−125m
175m−150m
200m−175m
225m−200m
1/s
0.005
0.000
−0.005
0
2
4
6
8
10
12
14
16
18
20
22
11 APR 89

Vertical Shears from Levine/Paulson ADCP

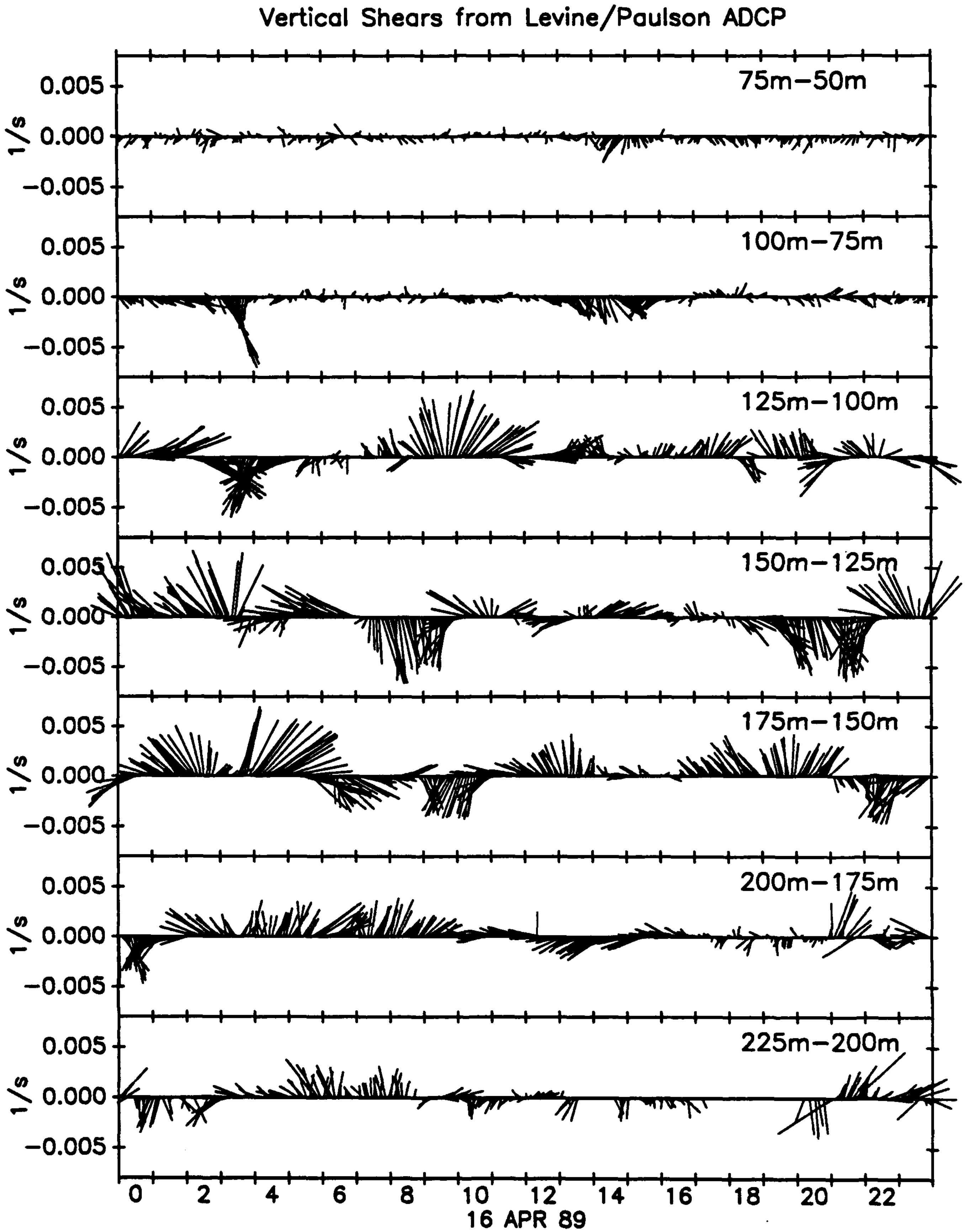


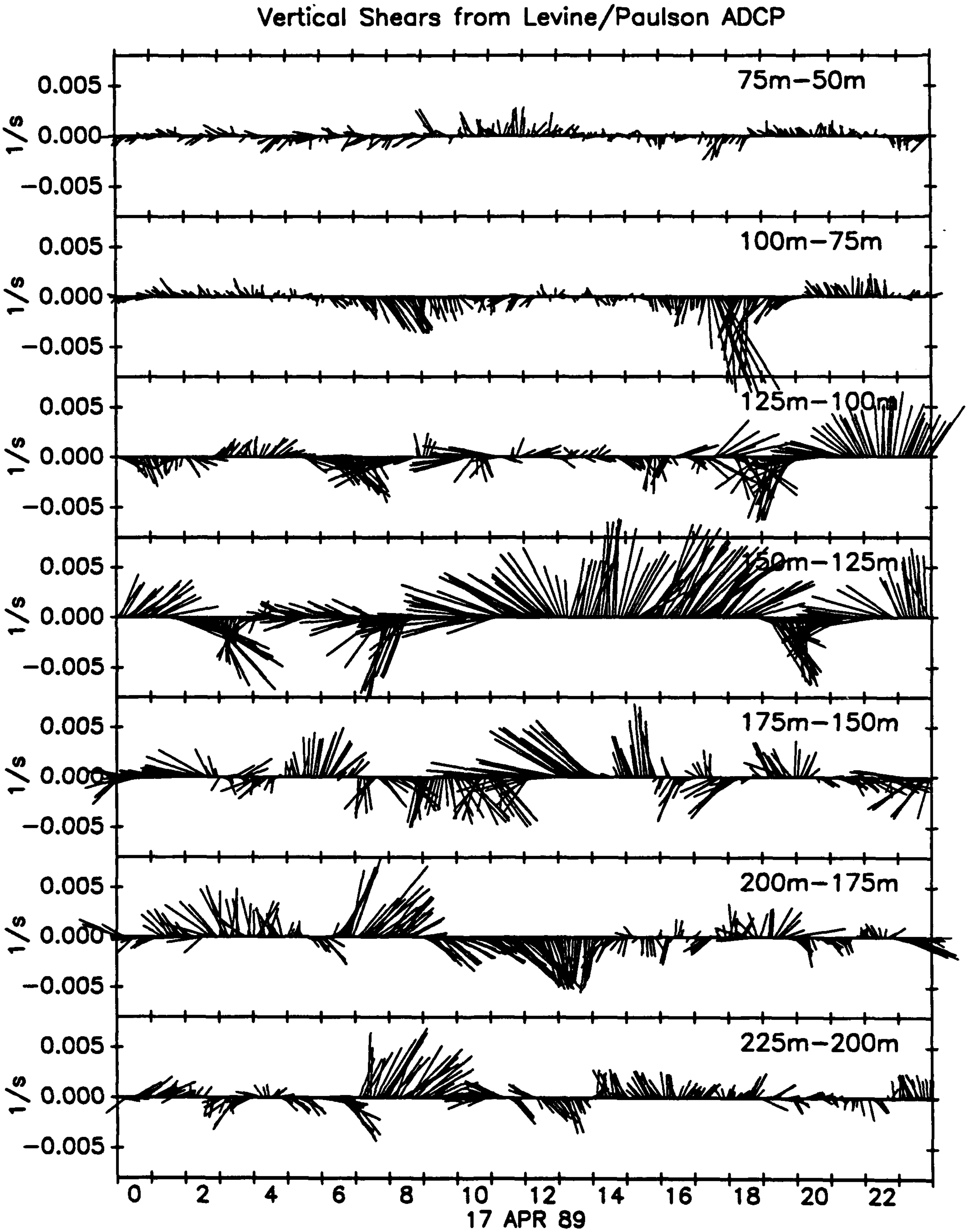

Vertical Shears from Levine/Paulson ADCP
75m–50m
100m–75m
125m–100m
150m–125m
175m–150m
200m–175m
225m–200m
1/s
0.005
0.000
–0.005
0
2
4
6
8
10
12
14
16
18
20
22
13 APR 89

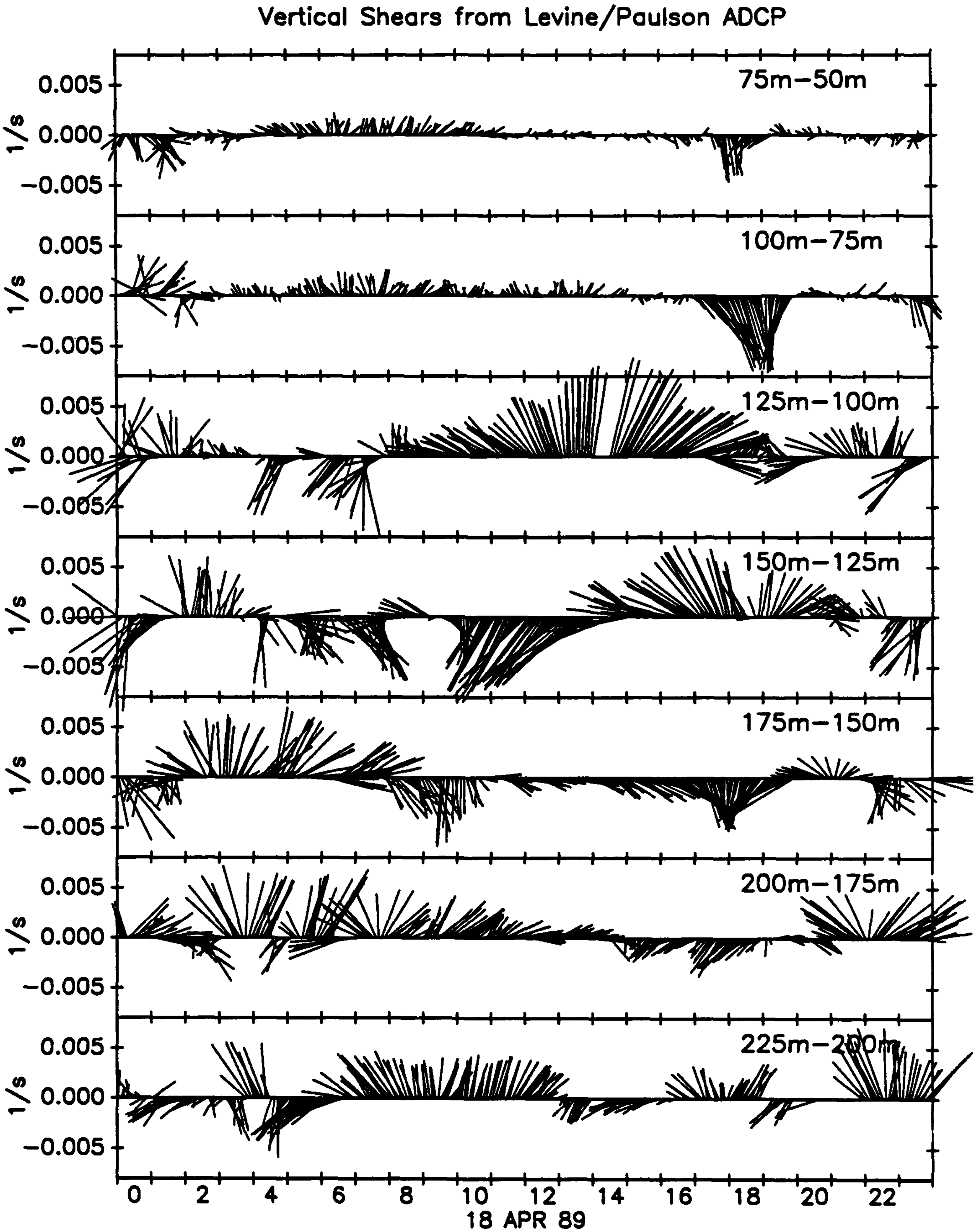

Vertical Shears from Levine/Paulson ADCP
75m–50m
100m–75m
125m–100m
150m–125m
175m–150m
200m–175m
225m–200m
0.005
0.000
–0.005
1/s
0
2
4
6
8
10
12
14
16
18
20
22
14 APR 89



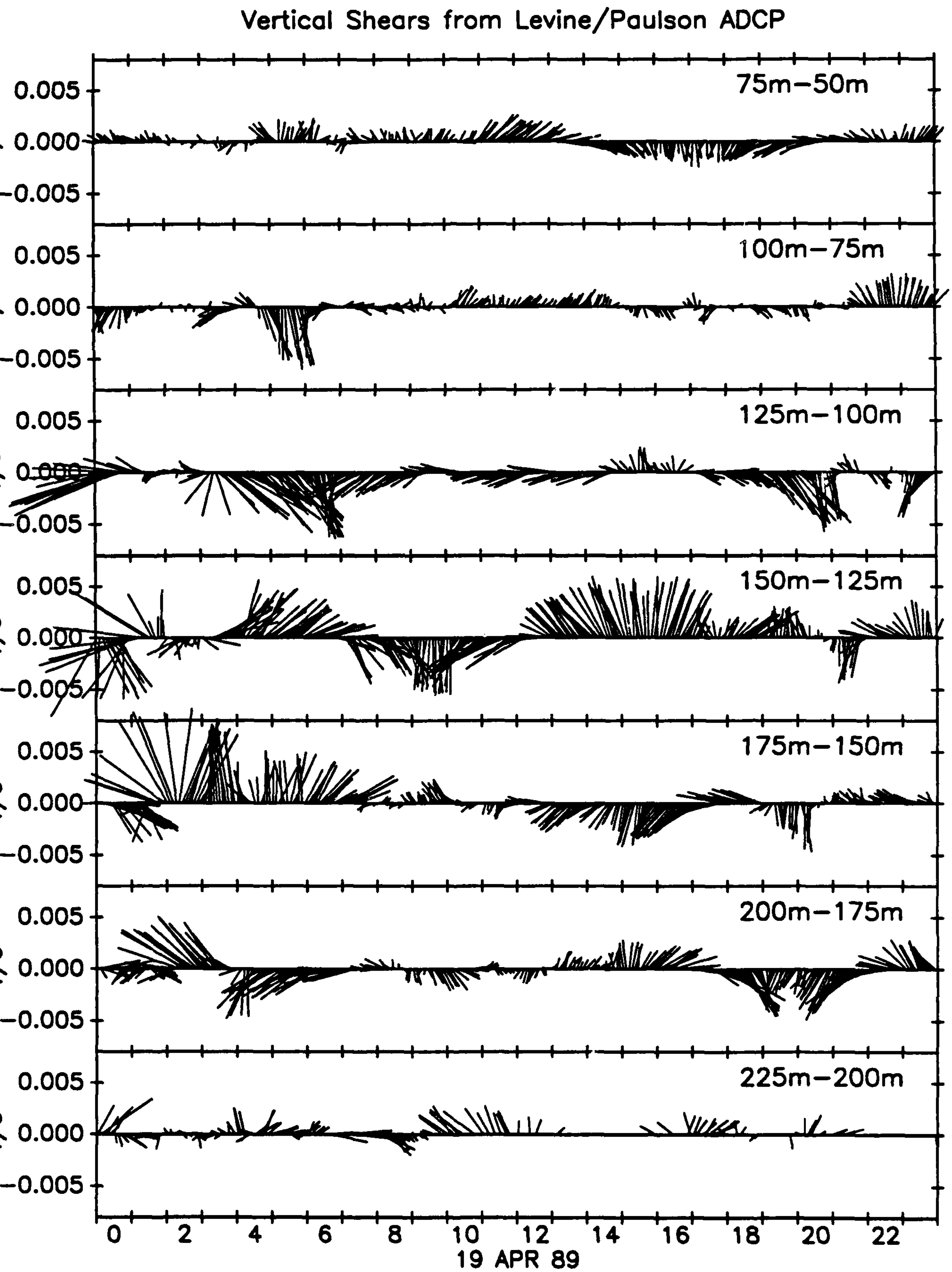
Vertical Shears from Levine/Paulson ADCP
75m−50m
100m−75m
125m−100m
150m−125m
175m−150m
200m−175m
225m−200m
1/s
0.005
0.000
−0.005
0
2
4
6
8
10
12
14
16
18
20
22
15 APR 89

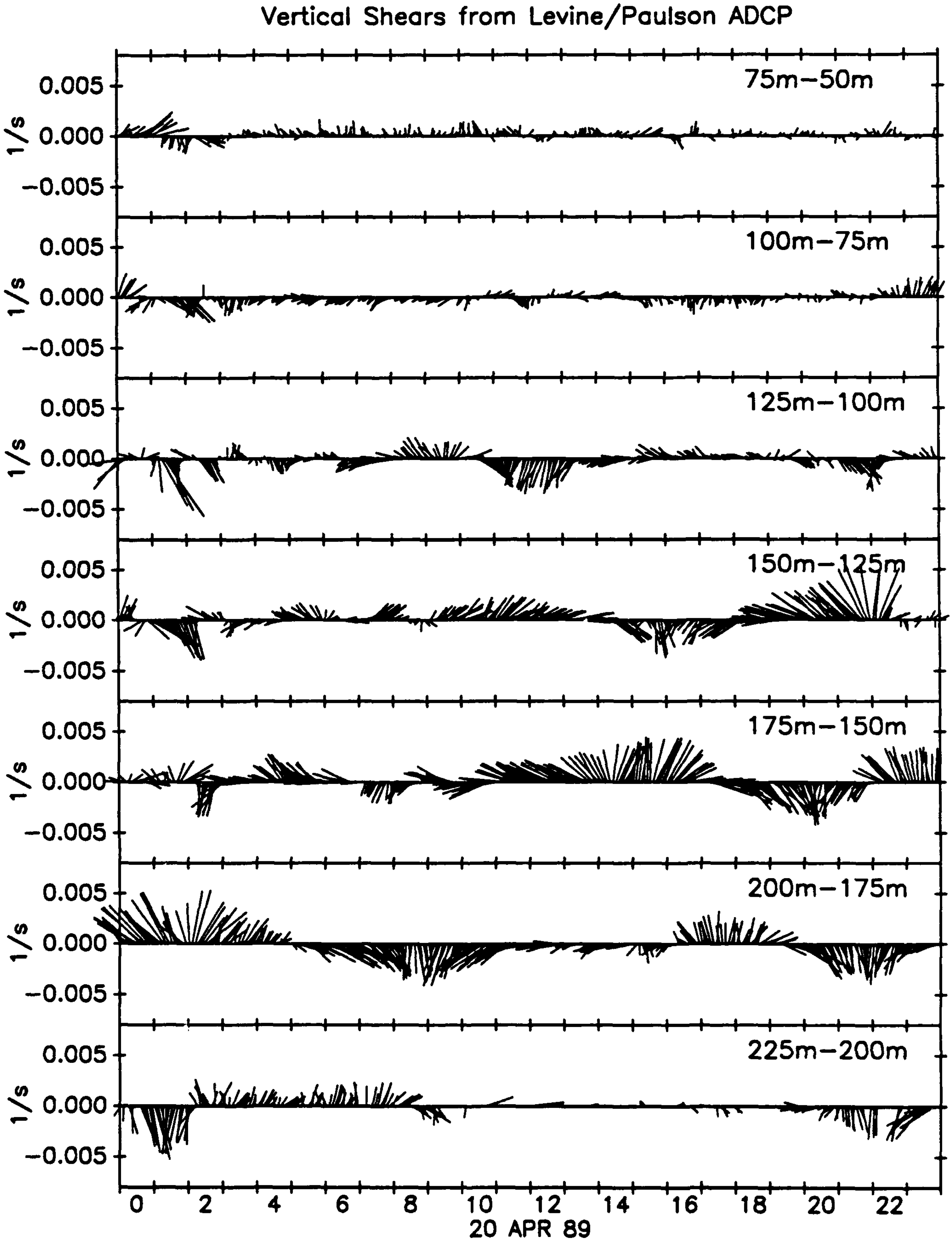

Vertical Shears from Levine/Paulson ADCP
75m−50m
100m−75m
125m−100m
150m−125m
175m−150m
200m−175m
225m−200m
0.005
0.000
−0.005
1/s
0
2
4
6
8
10
12
14
16
18
20
22
16 APR 89


Vertical Shears from Levine/Paulson ADCP
75m−50m
100m−75m
125m−100m
150m−125m
175m−150m
200m−175m
225m−200m
0.005
0.000
−0.005
1/s
0
2
4
6
8
10
12
14
16
18
20
22
17 APR 89



Vertical Shears from Levine/Paulson ADCP
75m–50m
100m–75m
125m–100m
150m–125m
175m–150m
200m–175m
225m–200m
0.005
0.000
–0.005
1/s
0
2
4
6
8
10
12
14
16
18
20
22
18 APR 89


Vertical Shears from Levine/Paulson ADCP
75m−50m
100m−75m
125m−100m
150m−125m
175m−150m
200m−175m
225m−200m
0.005
0.000
−0.005
1/s
0
2
4
6
8
10
12
14
16
18
20
22
19 APR 89


Vertical Shears from Levine/Paulson ADCP
75m–50m
100m–75m
125m–100m
150m–125m
175m–150m
200m–175m
225m–200m
0.005
0.000
−0.005
1/s
0
2
4
6
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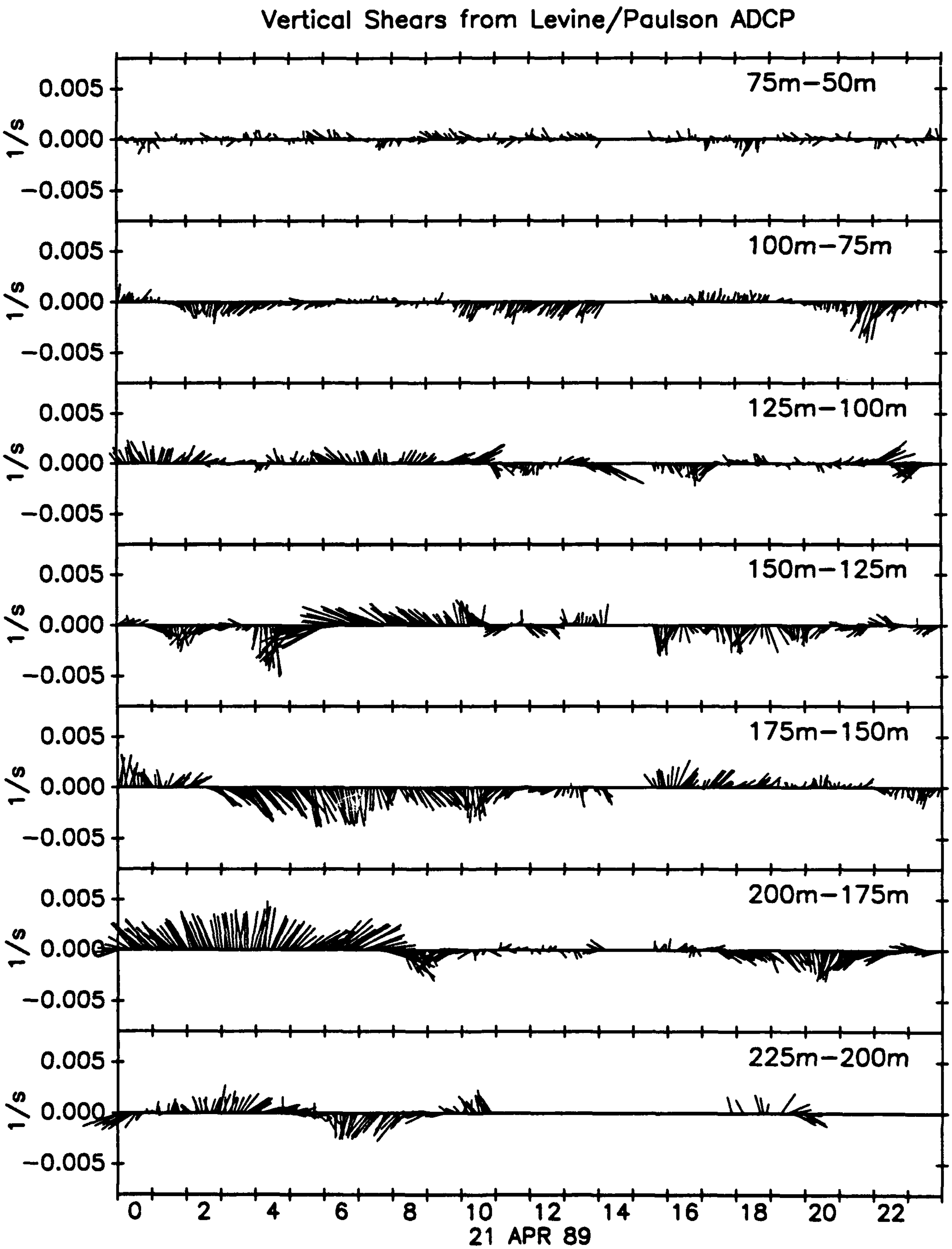
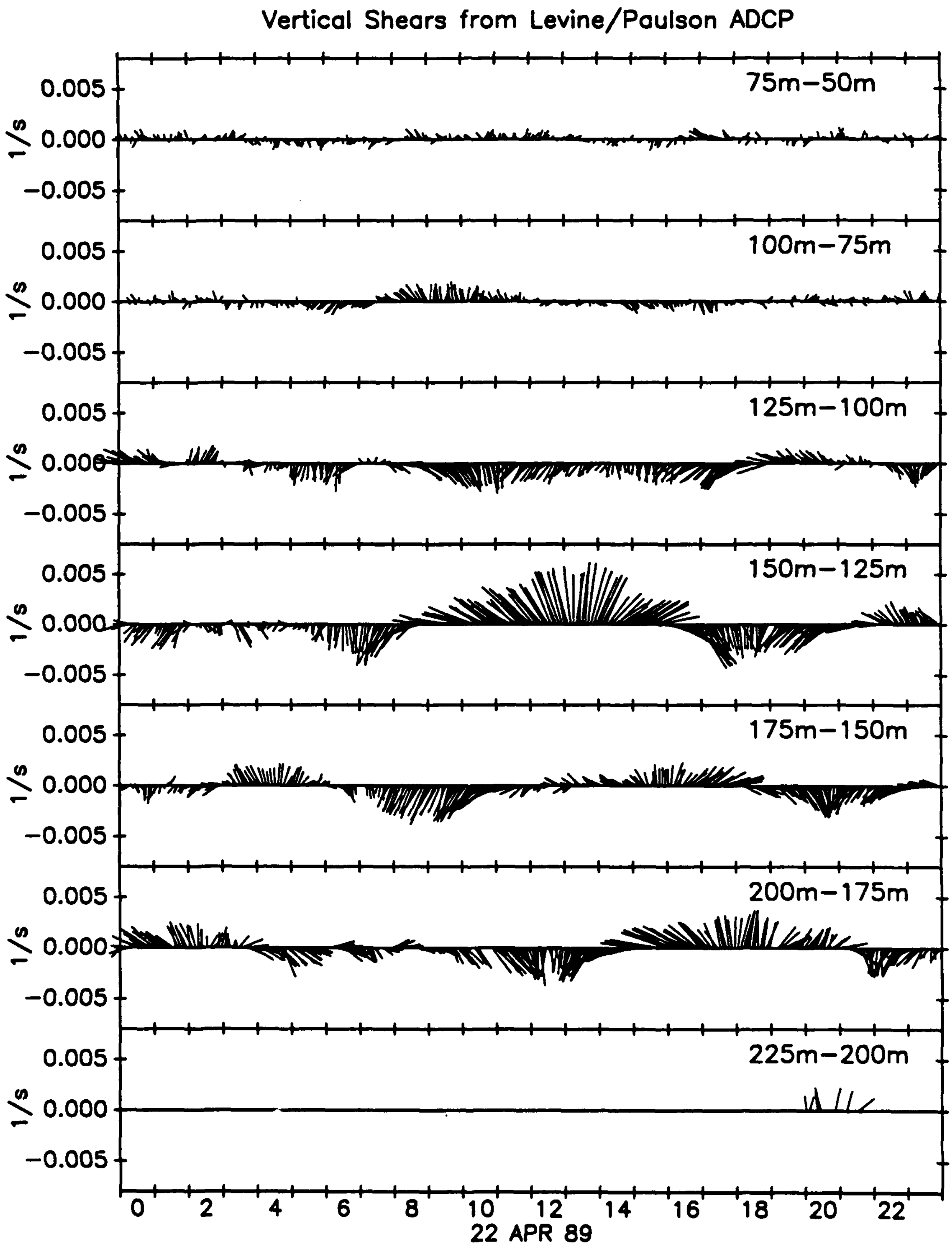
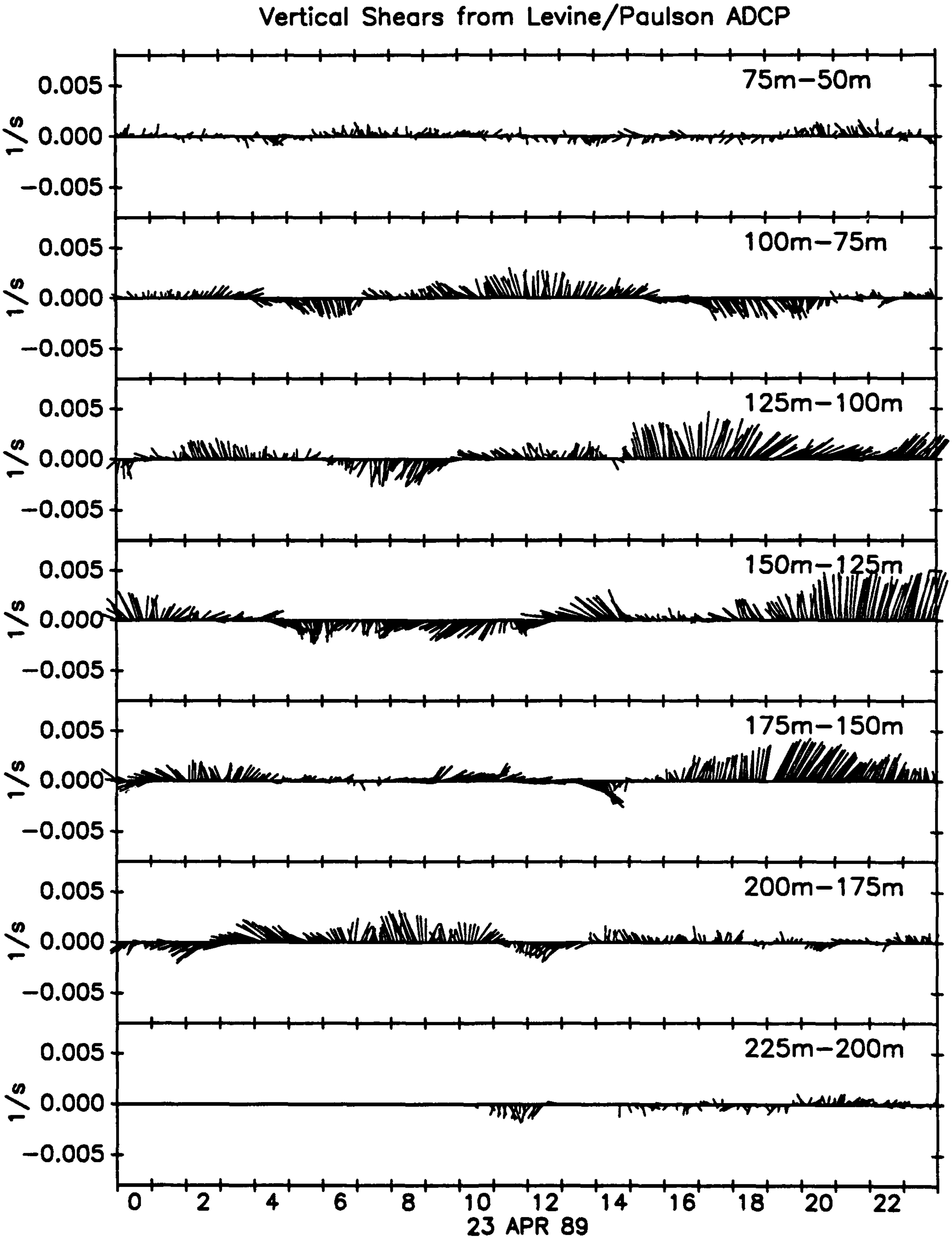
12
14
16
18
20
22
20 APR 89


Vertical Shears from Levine/Paulson ADCP
75m–50m
100m–75m
125m–100m
150m–125m
175m–150m
200m–175m
225m–200m
1/s
0.005
0.000
–0.005
0 2 4 6 8 10 12 14 16 18 20 22
21 APR 89


Vertical Shears from Levine/Paulson ADCP
75m–50m
100m–75m
125m–100m
150m–125m
175m–150m
200m–175m
225m–200m
0.005
0.000
–0.005
1/s
0
2
4
6
8
10
12
14
16
18
20
22
22 APR 89



Vertical Shears from Levine/Paulson ADCP
75m–50m
100m–75m
125m–100m
150m–125m
175m–150m
200m–175m
225m–200m
1/s
0.005
0.000
–0.005
0
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4
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8
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12
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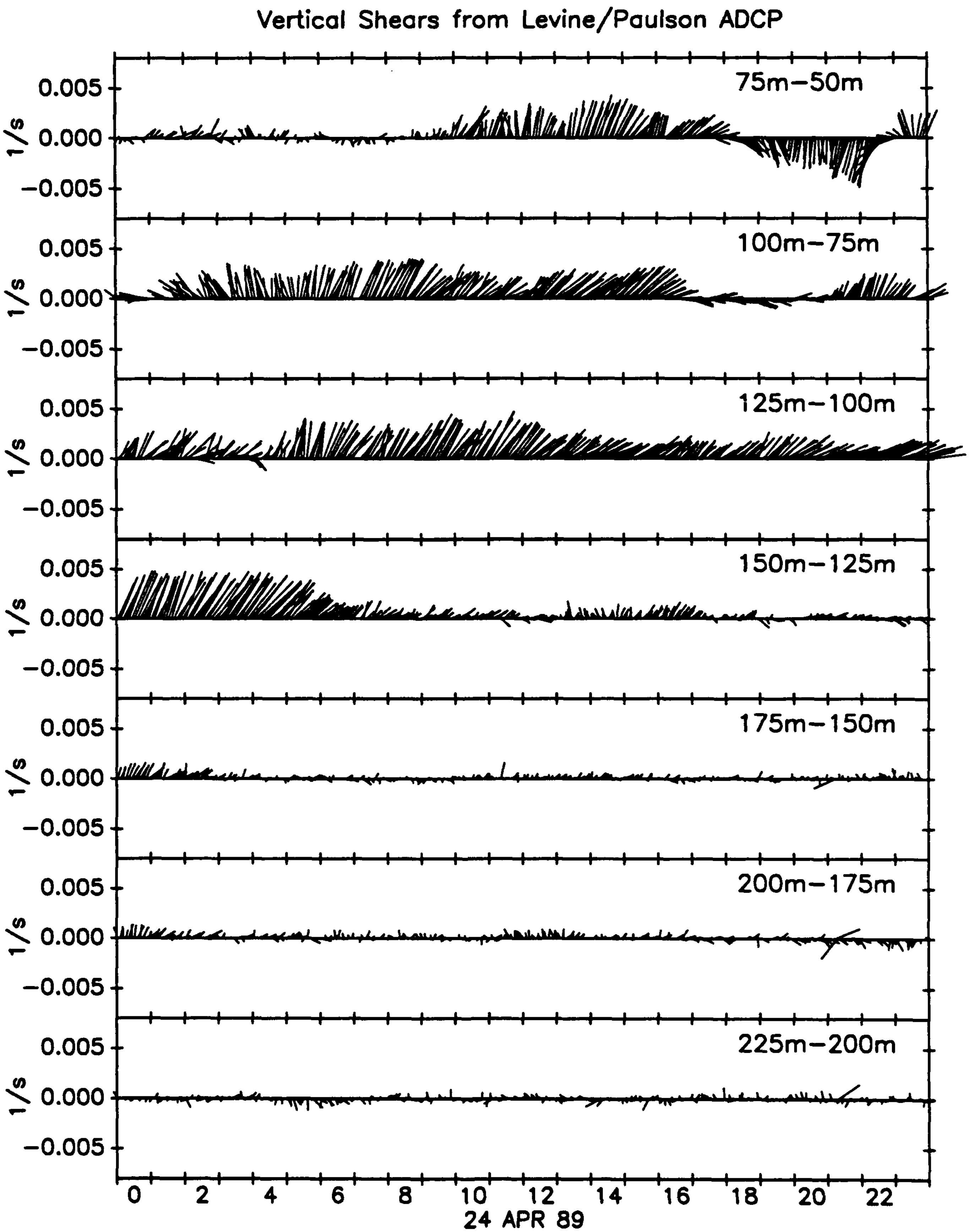
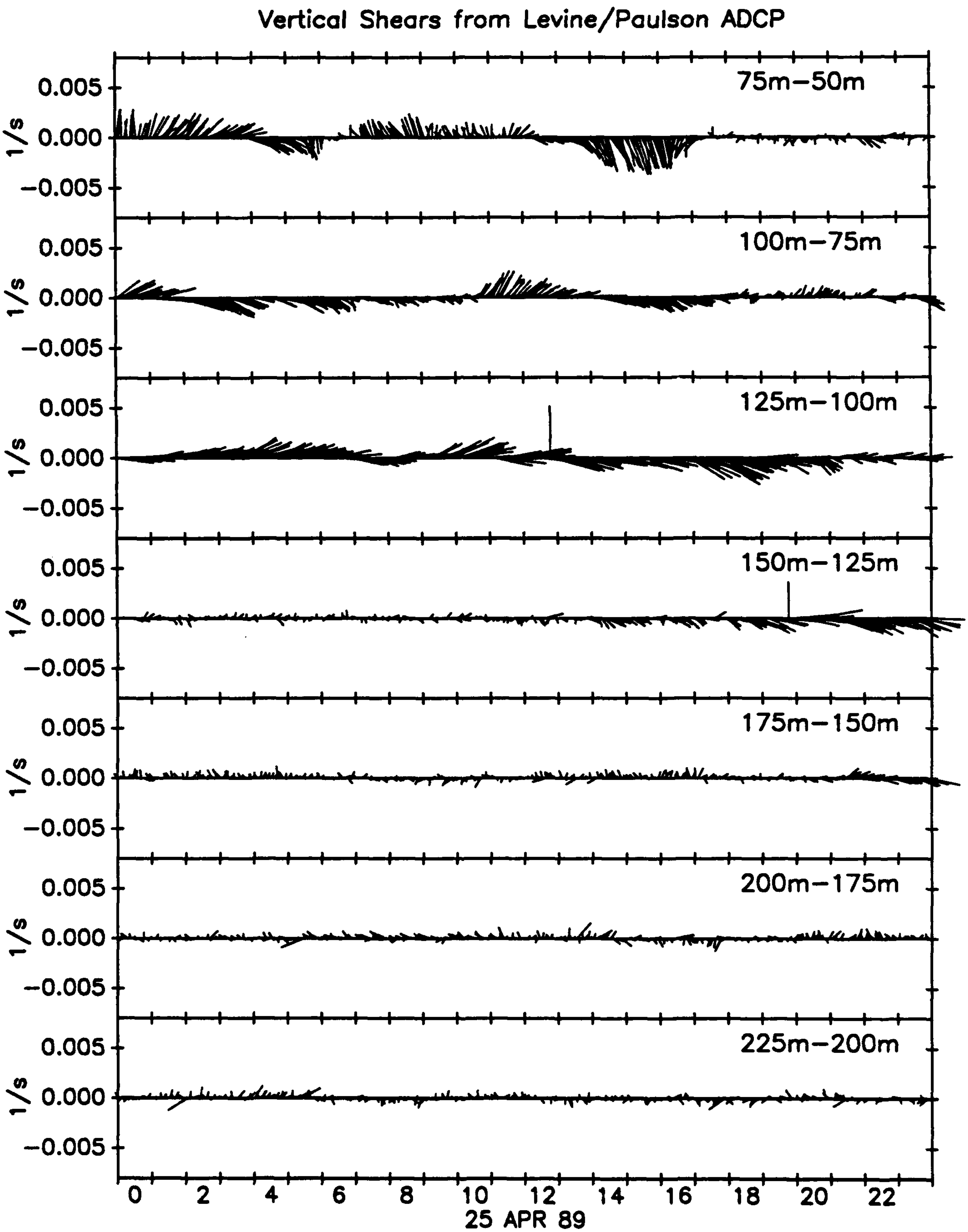
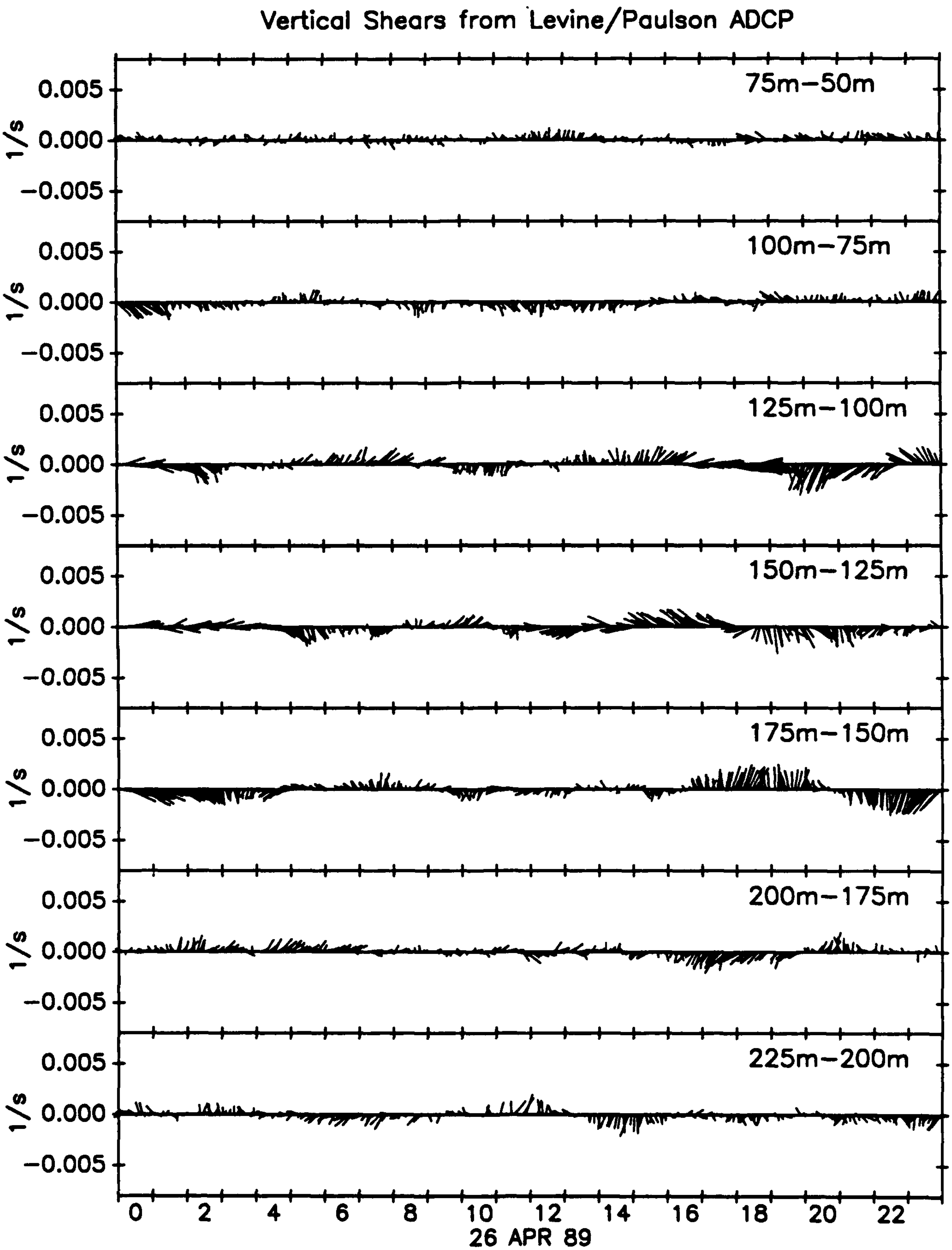
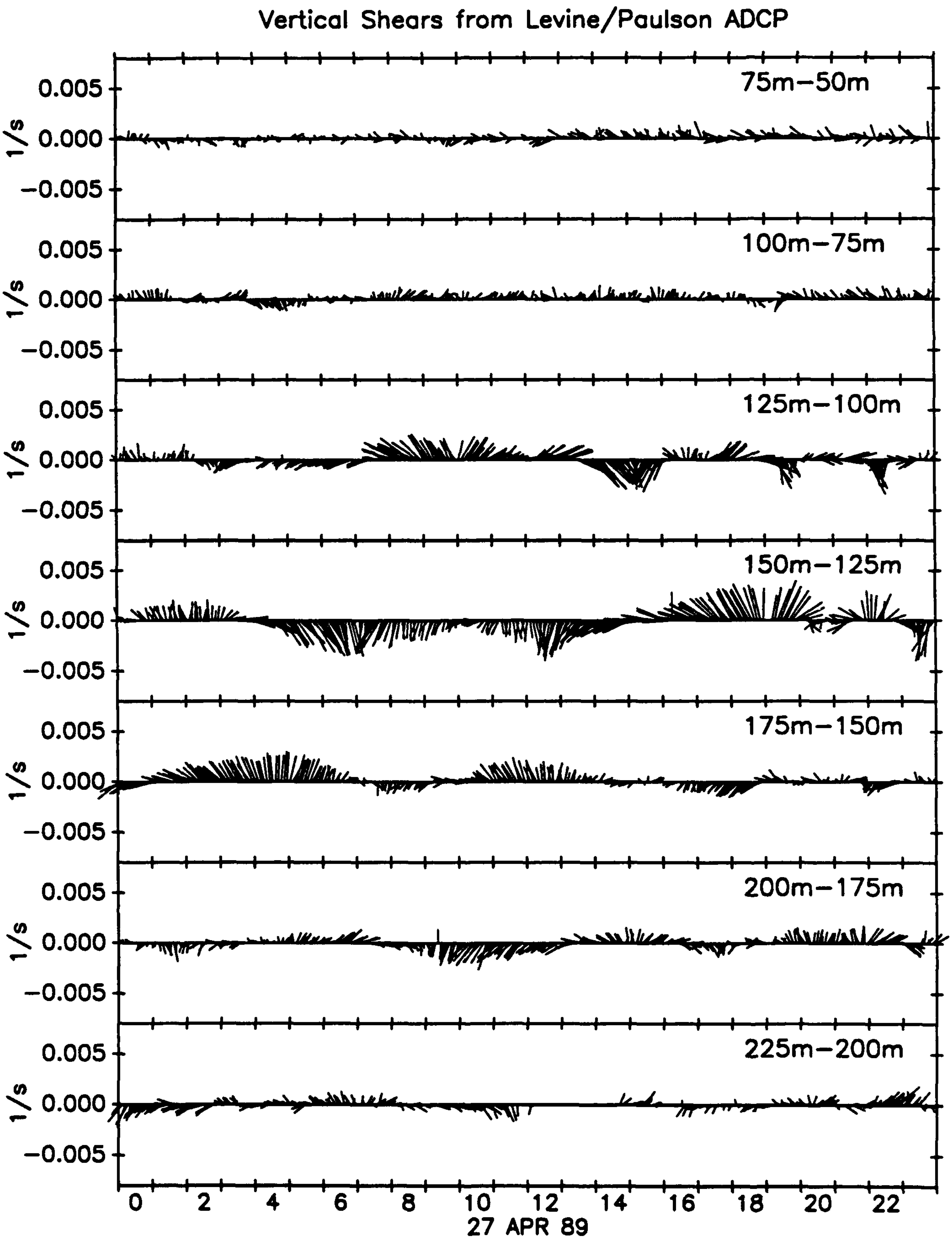
16
18
20
22
23 APR 89



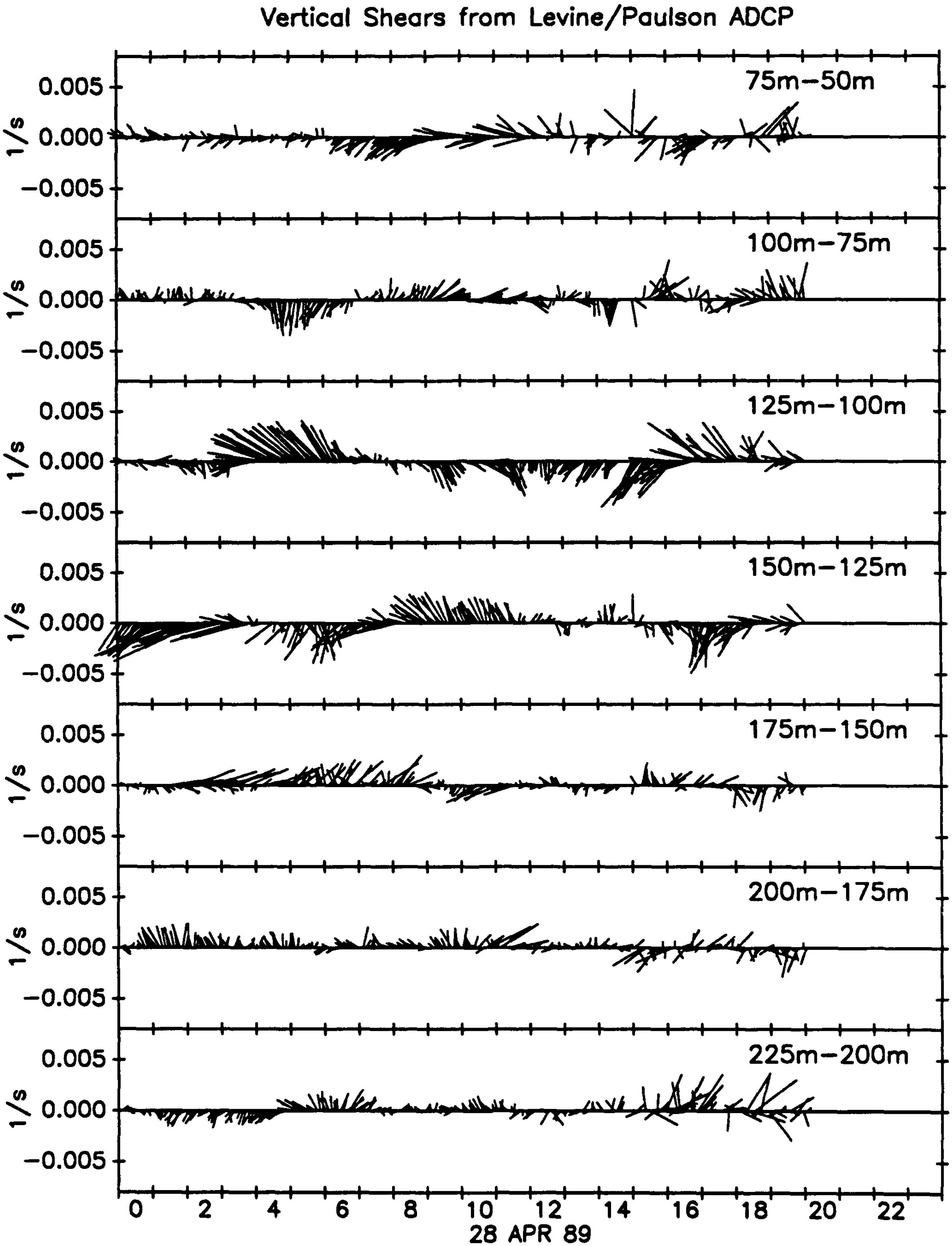
Vertical Shears from Levine/Paulson ADCP
75m−50m
100m−75m
125m−100m
150m−125m
175m−150m
200m−175m
225m−200m
0.005
0.000
−0.005
1/s
0
2
4
6
8
10
12
14
16
18
20
22
24 APR 89


Vertical Shears from Levine/Paulson ADCP
75m−50m
100m−75m
125m−100m
150m−125m
175m−150m
200m−175m
225m−200m
1/s
0.005
0.000
−0.005
0 2 4 6 8 10 12 14 16 18 20 22
25 APR 89


Vertical Shears from Levine/Paulson ADCP
75m–50m
100m–75m
125m–100m
150m–125m
175m–150m
200m–175m
225m–200m
0.005
0.000
–0.005
1/s
0
2
4
6
8
10
12
14
16
18
20
22
26 APR 89



Vertical Shears from Levine/Paulson ADCP
75m–50m
100m–75m
125m–100m
150m–125m
175m–150m
200m–175m
225m–200m
0.005
0.000
–0.005
1/s
0
2
4
6
8
10
12
14
16
18
20
22
27 APR 89



Vertical Shears from Levine/Paulson ADCP
75m–50m
100m–75m
125m–100m
150m–125m
175m–150m
200m–175m
225m–200m
1/s
0.005
0.000
–0.005
0
2
4
6
8
10
12
14
16
18
20
22
28 APR 89

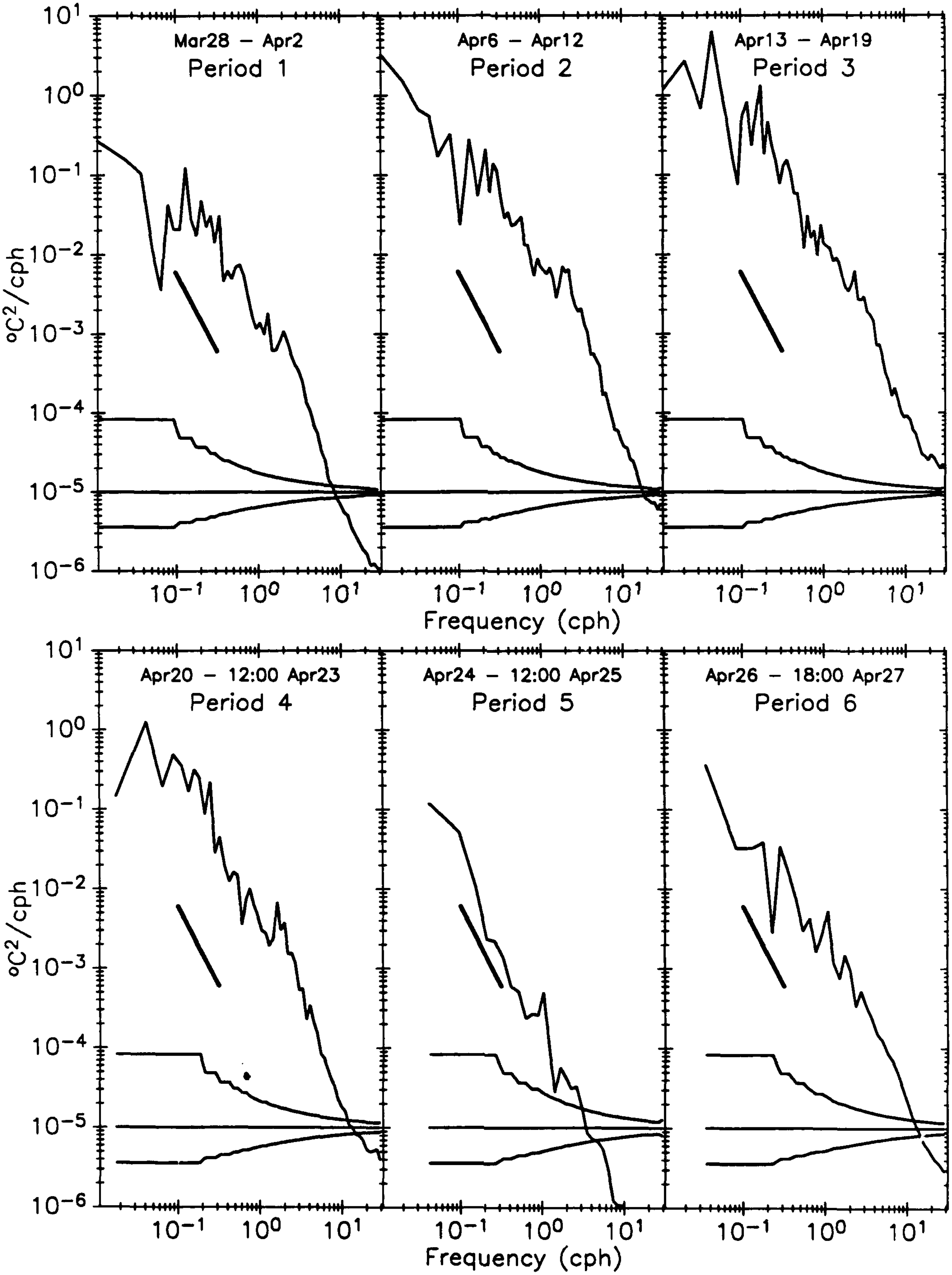
AUTOSPECTRA OF TEMPERATURE AT CENTRAL SITE

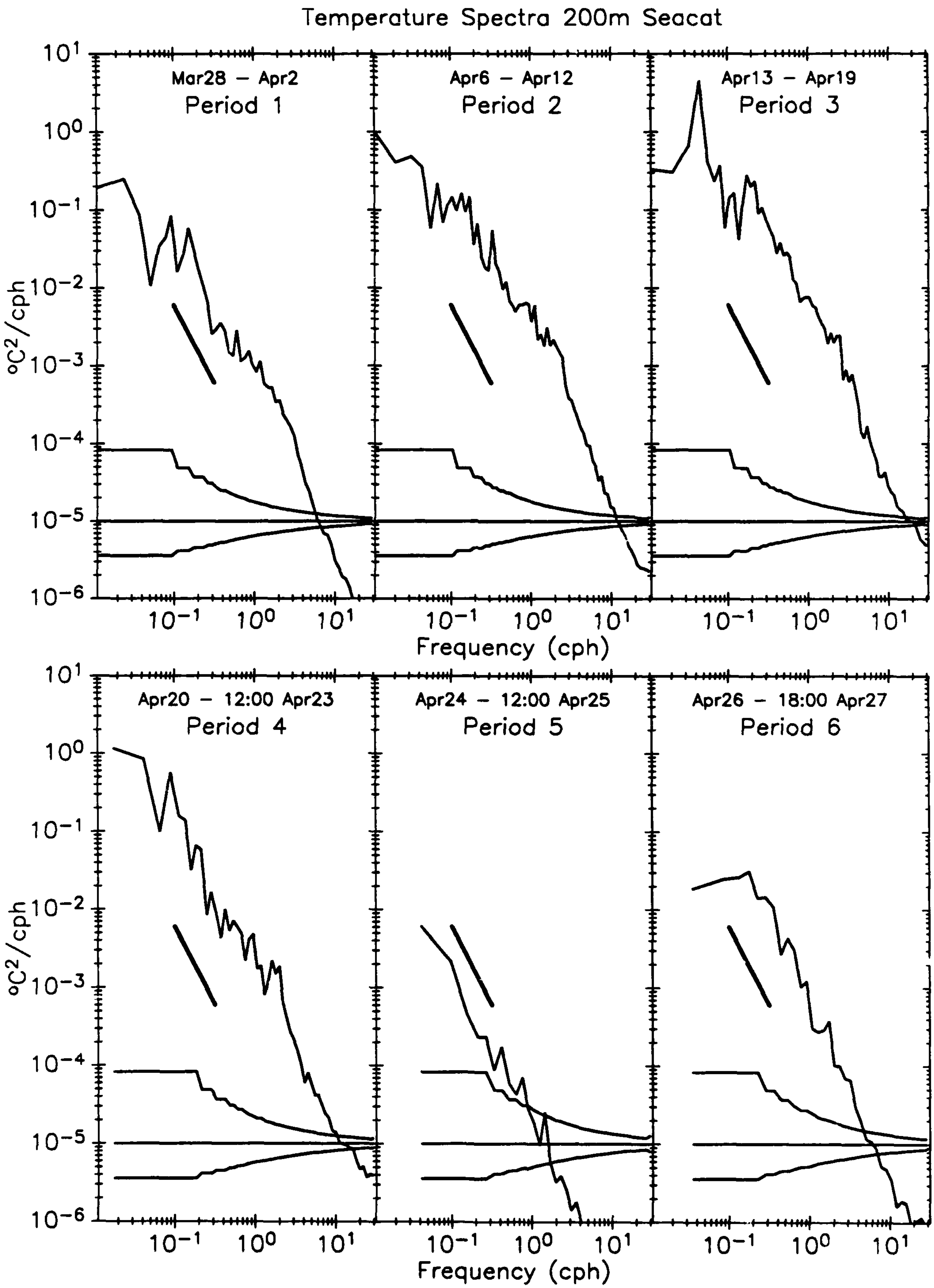
The following three plots show temperature spectra from six time periods defined as follows:

Period	Duration	Comment
1	Mar 28 through Apr 2 (Day 87 through day 92)	Deep water
2	Apr 6 through Apr 12 (Day 96 through day 102)	Approaching Yermak Plateau
3	Apr 13 through Apr 19 (Day 103 through day 109)	On slope of Yermak Plateau Large diurnal oscillations
4	Apr 20 through 1200 Apr 23 (Day 110 through 1200 day 113)	On slope of Yermak Plateau Reduced diurnal oscillations
5	Apr 24 through 1200 Apr 25 (Day 114 through 1200 day 115)	Eddy
6	Apr 26 through 1800 Apr 27 (Day 116 through 1800 day 117)	After eddy

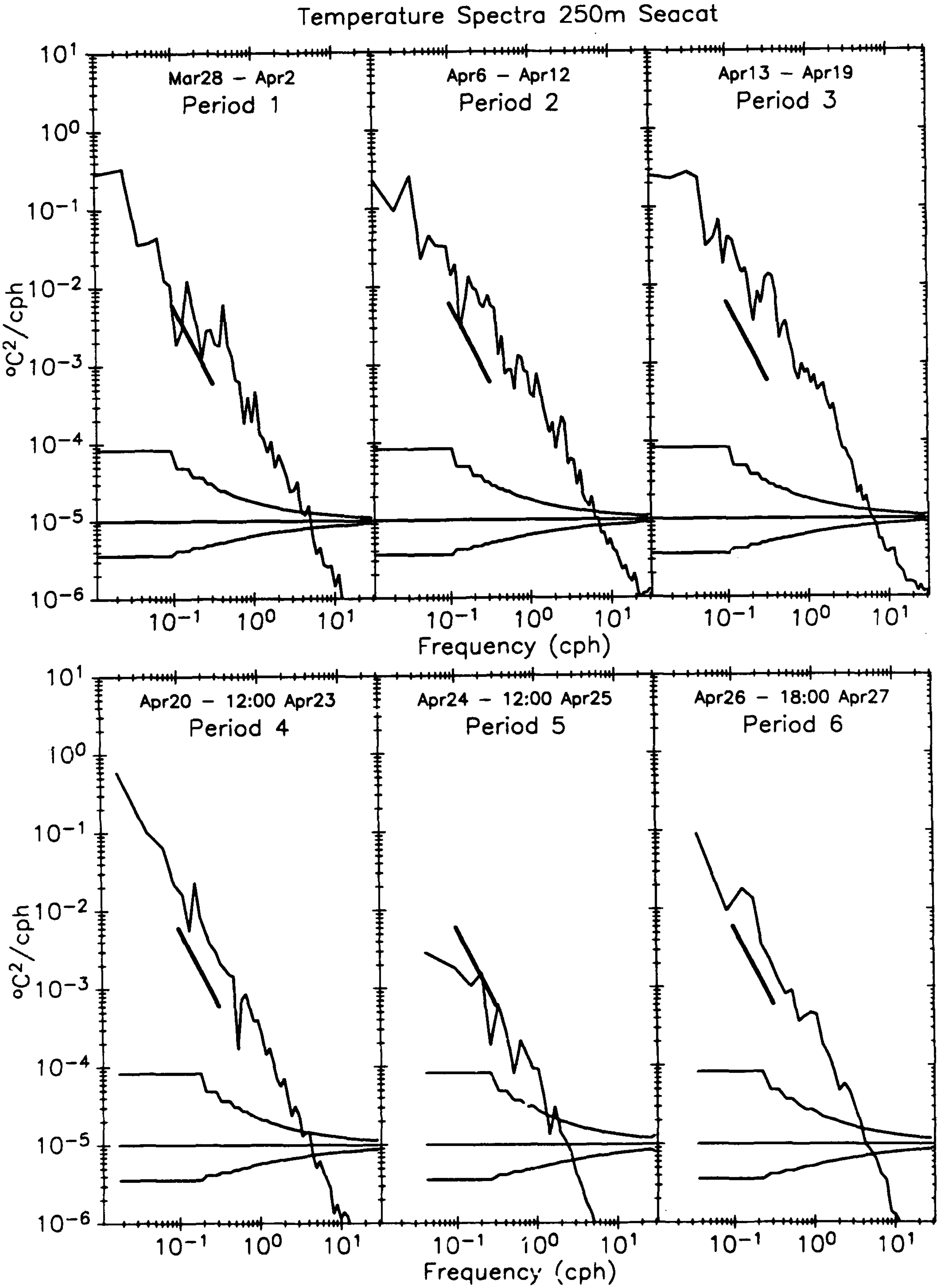
The data are from Seacat temperature-conductivity recorders. A heavy, solid line segment with a -2 slope is plotted at the same level in each panel for reference.

Temperature Spectra 150m Seacat





Temperature Spectra 200m Seacat
Mar28 – Apr2
Period 1
Apr6 – Apr12
Period 2
Apr13 – Apr19
Period 3
Apr20 – 12:00 Apr23
Period 4
Apr24 – 12:00 Apr25
Period 5
Apr26 – 18:00 Apr27
Period 6
°C²/cph
Frequency (cph)
10¹
10⁰
10⁻¹
10⁻²
10⁻³
10⁻⁴
10⁻⁵
10⁻⁶

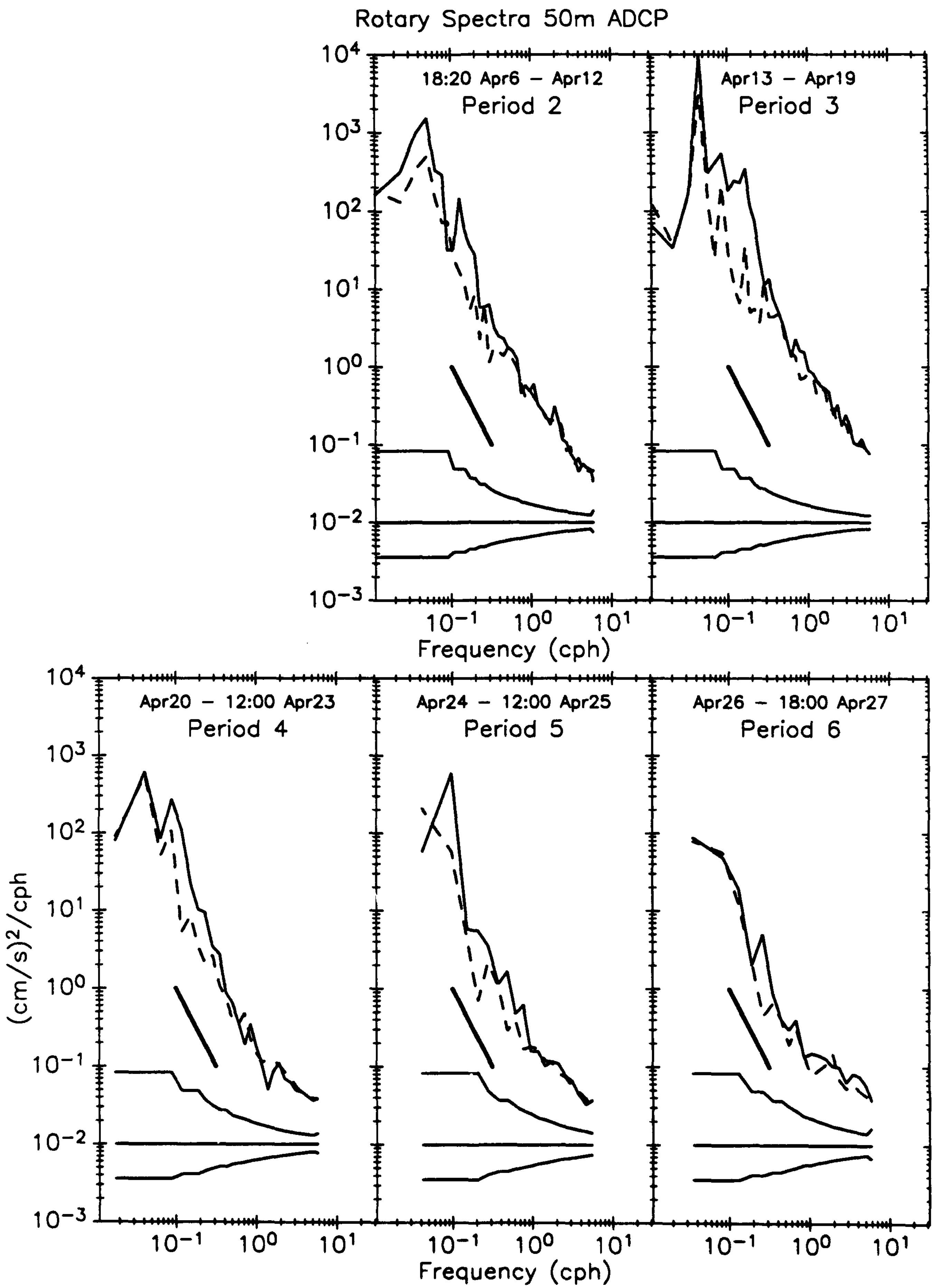

Temperature Spectra 250m Seacat
Mar28 – Apr2
Period 1
Apr6 – Apr12
Period 2
Apr13 – Apr19
Period 3
Apr20 – 12:00 Apr23
Period 4
Apr24 – 12:00 Apr25
Period 5
Apr26 – 18:00 Apr27
Period 6
$^oC^2$/cph
Frequency (cph)
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}

AUTOSPECTRA OF VELOCITY AT CENTRAL SITE

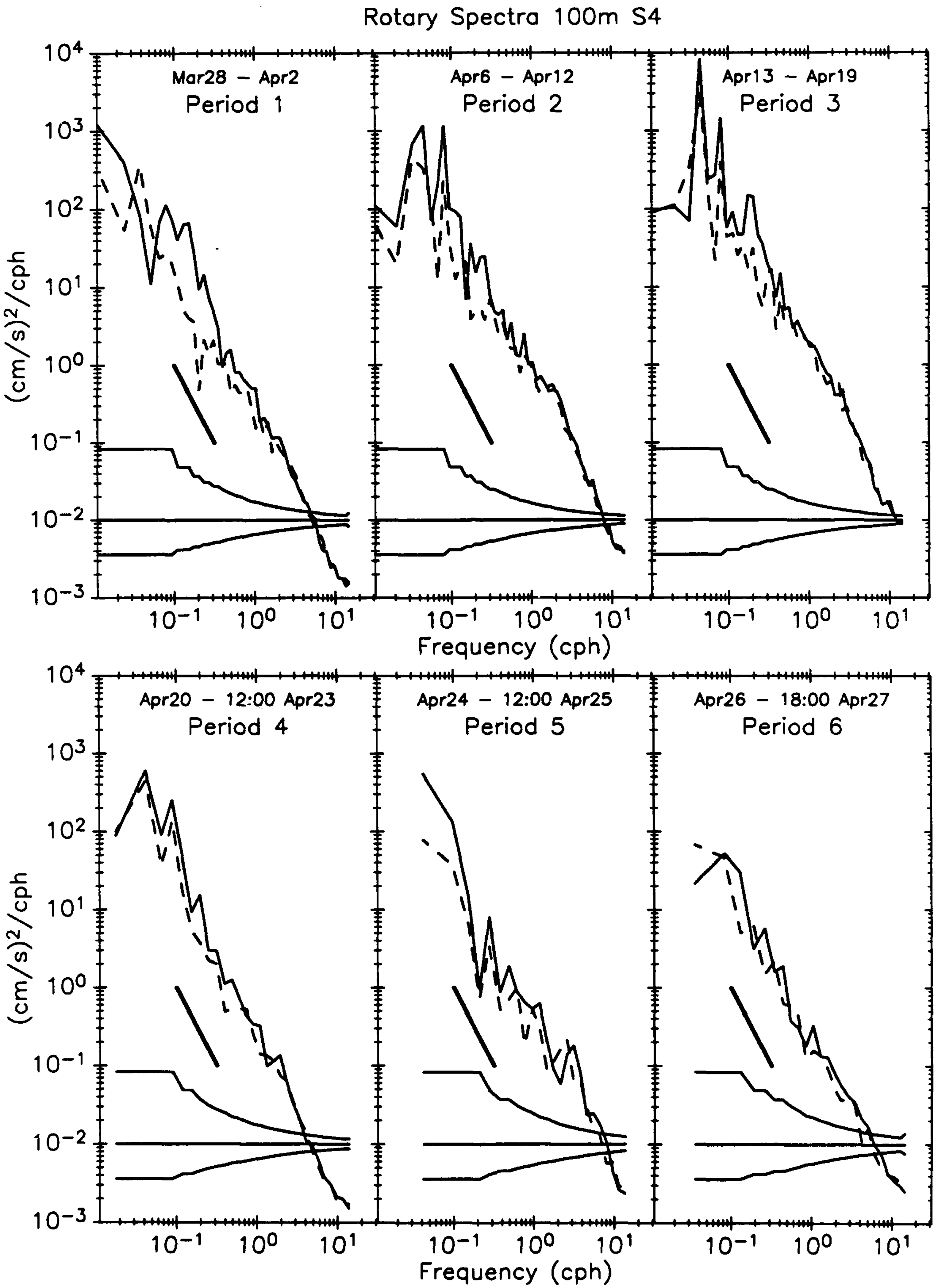
The following five plots show rotary spectra from 6 time periods defined as follows:

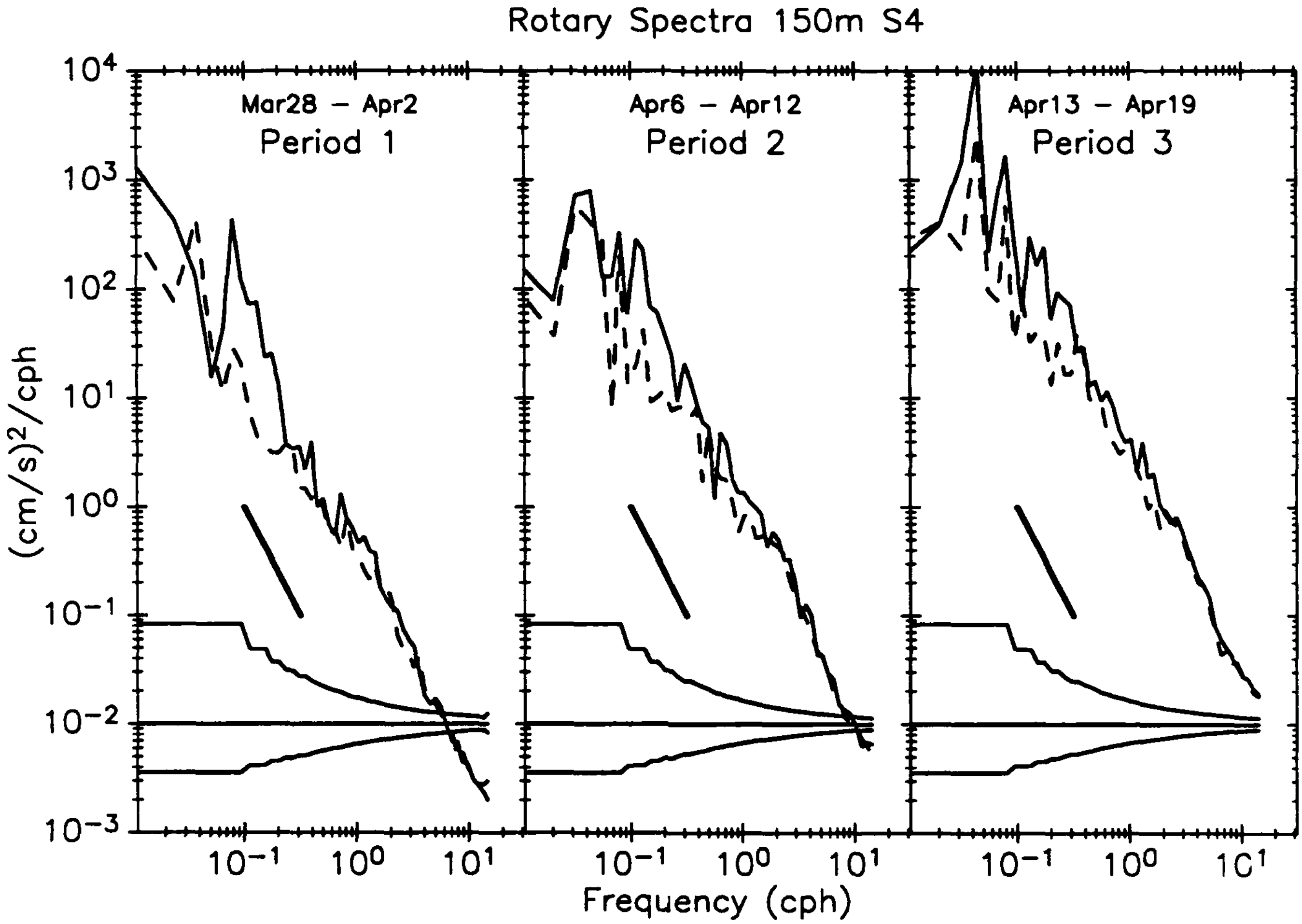
Period	Duration	Comment
1	Mar 28 through Apr 2 (Day 87 through day 92)	Deep water
2	Apr 6 through Apr 12 (Day 96 through day 102)	Approaching Yermak Plateau
3	Apr 13 through Apr 19 (Day 103 through day 109)	On slope of Yermak Plateau Large diurnal oscillations
4	Apr 20 through 1200 Apr 23 (Day 110 through 1200 day 113)	On slope of Yermak Plateau Reduced diurnal oscillations
5	Apr 24 through 1200 Apr 25 (Day 114 through 1200 day 115)	Eddy
6	Apr 26 through 1800 Apr 27 (Day 116 through 1800 day 117)	After eddy

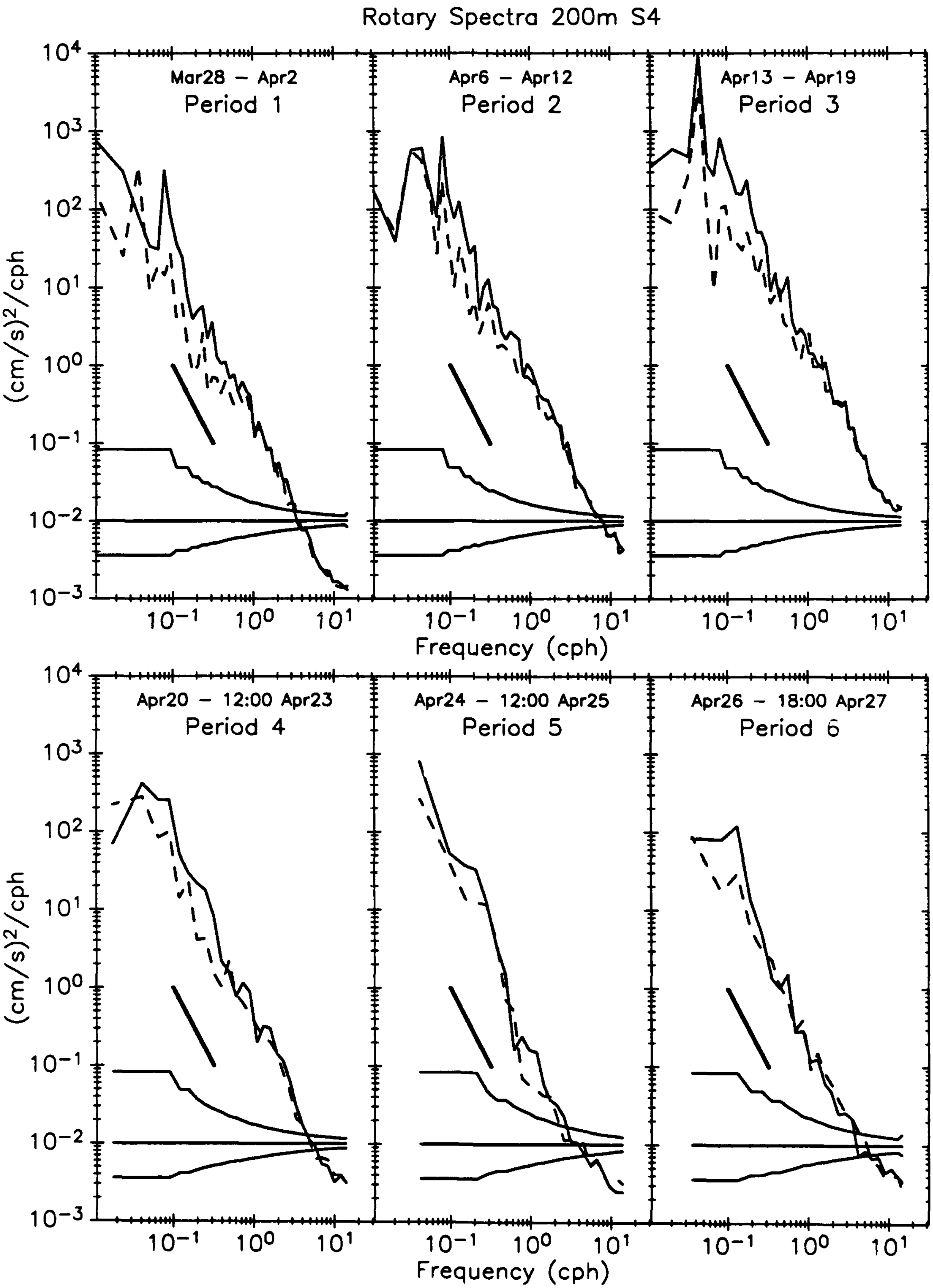
The data at 50 m are from the ADCP; spectra at 100, 150, 200 and 250 m are from velocities measured by S-4s. The clockwise component is plotted as a solid line; the anticlockwise is given by the dashed line. A heavy, solid line segment with a -2 slope is plotted at the same level in each panel for reference.



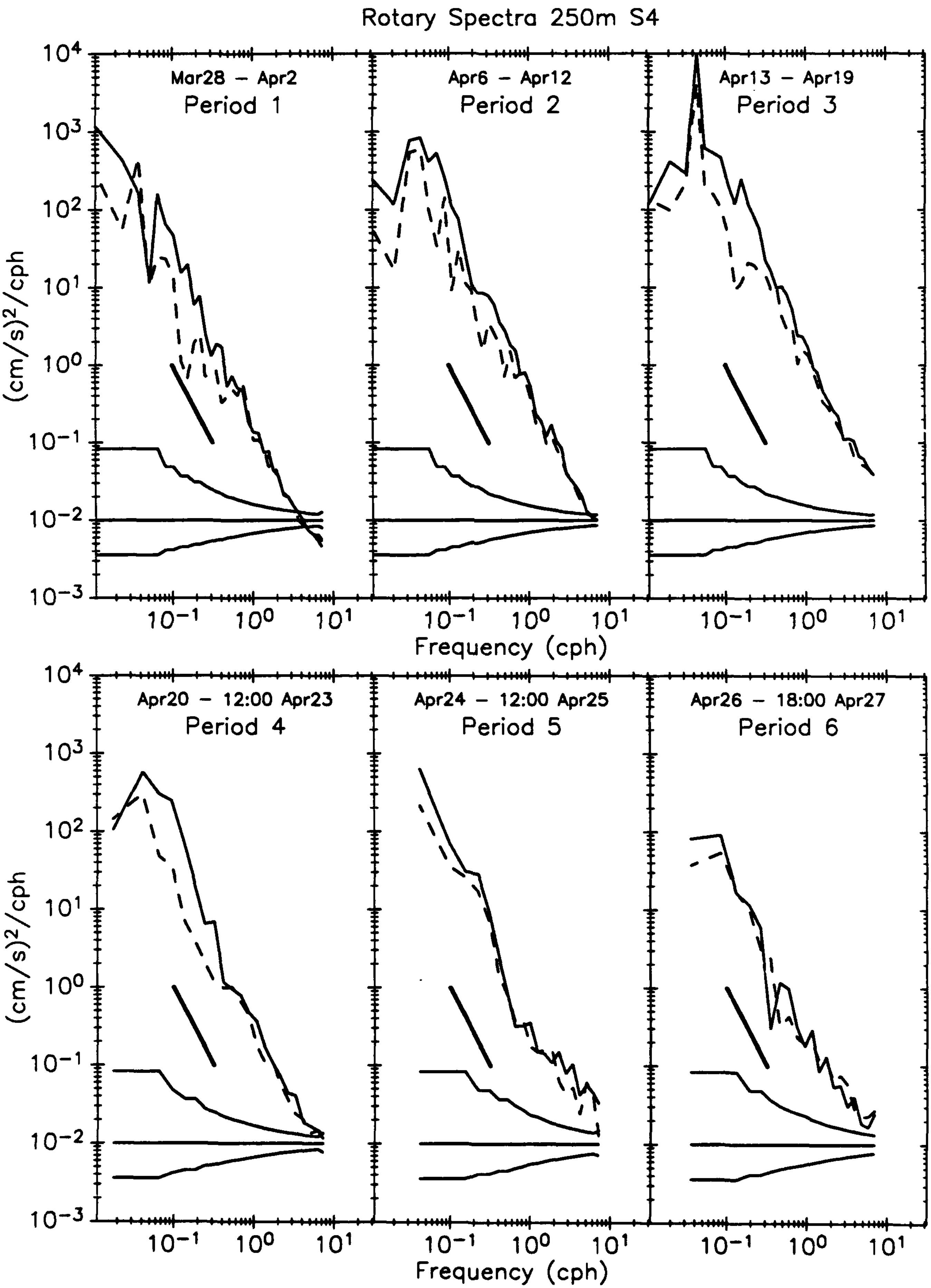
Rotary Spectra 50m ADCP
18:20 Apr6 – Apr12
Period 2
Apr13 – Apr19
Period 3
Apr20 – 12:00 Apr23
Period 4
Apr24 – 12:00 Apr25
Period 5
Apr26 – 18:00 Apr27
Period 6
10^4
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
(cm/s)^2/cph
10^-1
10^0
10^1
Frequency (cph)


Rotary Spectra 100m S4
Mar28 – Apr2
Period 1
Apr6 – Apr12
Period 2
Apr13 – Apr19
Period 3
Apr20 – 12:00 Apr23
Period 4
Apr24 – 12:00 Apr25
Period 5
Apr26 – 18:00 Apr27
Period 6
(cm/s)^2/cph
Frequency (cph)
10^4
10^3
10^2
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-1}
10^0
10^1


Rotary Spectra 150m S4
Mar28 – Apr2
Period 1
Apr6 – Apr12
Period 2
Apr13 – Apr19
Period 3
(cm/s)²/cph
Frequency (cph)



Rotary Spectra 200m S4
Mar28 – Apr2
Period 1
Apr6 – Apr12
Period 2
Apr13 – Apr19
Period 3
Apr20 – 12:00 Apr23
Period 4
Apr24 – 12:00 Apr25
Period 5
Apr26 – 18:00 Apr27
Period 6
(cm/s)^2/cph
Frequency (cph)
10^{4}
10^{3}
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}



Rotary Spectra 250m S4
Mar28 – Apr2
Period 1
Apr6 – Apr12
Period 2
Apr13 – Apr19
Period 3
Apr20 – 12:00 Apr23
Period 4
Apr24 – 12:00 Apr25
Period 5
Apr26 – 18:00 Apr27
Period 6
(cm/s)²/cph
Frequency (cph)